Language development in children with psychiatric impairment.
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2 The causality of comorbidity

Claudia Blankenstijn and Annette Scheper

2.1 Introduction

As described in Chapter 1, a comorbid relationship between language and psychiatric disabilities exists so frequently that the co-occurrence of these impairments cannot be a chance occurrence; it seems to be a systematic pattern that theories of development have to account for. In every-day interaction, however, the relationship between symptoms of LI and PI might be difficult to establish. The symptoms of a language impairment (LI) and a psychiatric impairment (PI) can appear very close to one another in time (Example 1).

Example 1

William: They never let me have the ball. I HATE THEM!
Teacher: (calmly mirroring his statement) You do?
William: (yelling) Don't you call me a DOO!

It can be seen in Example 1 that children's emotional/behavioural disorders can easily lead to a breakdown in linguistic communicative interaction on the one hand, whereas on the other hand their language disorders can lead to miscommunication causing feelings of frustration. The two problems are so interwoven that it is difficult to establish the causal relationship between the two. It is not difficult to imagine that the complexity of this relationship has made it difficult to develop adequate 'models of analysis' that separate LI from PI symptoms. Such a model should be based on linguistic and social-cognitive developmental theories that explicitly account for the relationship between LI and PI. Such a theory should provide a complete and coherent developmental framework including atypical development (Bishop, 1997) and explaining the relatively high co-occurrence of LI and PI. There is no current theory that makes explicit claims about the comorbidity issue; clearly this is a gap.

Since the comorbidity of both disorders is an empirical central issue in this thesis, we need to look for starting points in some developmental theories in order to infer some possible explanations for the co-occurrence of LI and PI. Three possible causal relationships between LI and PI will be put forward and explained in 2.2. Next, we will describe how different developmental theories are thought to explain one or more of these basic causal relationships in 2.3. It should become clear which theories contribute more to the comorbidity issue than others, as presented in 2.4. Finally, in 2.5, we will formulate the main research questions.
2.2 Causal relationships of comorbidity

In empirical research involving large groups of language disordered psychiatrically impaired children (LIPI-children) (see 1.3), three basic causal relationships are most frequently used to explain the comorbidity (see Table 2.1).

Table 2.1 Three causal relationships of comorbidity

<table>
<thead>
<tr>
<th>Causal relationships</th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
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<tbody>
<tr>
<td>1. PI → LI</td>
<td>(Third risk factors →)</td>
<td>PI →</td>
<td>PI + LI</td>
</tr>
<tr>
<td>2. LI → PI</td>
<td>(Third risk factors →)</td>
<td>LI →</td>
<td>LI + PI</td>
</tr>
<tr>
<td>3. LI ↔ PI</td>
<td>(Third risk factor →)</td>
<td>(LI ↔ PI)</td>
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The psychiatric disorder may cause the language disorder resulting in the comorbid existence of PI and LI (Causal relationship 1) or the language disorder may cause the psychiatric disorder resulting in the comorbid existence of LI and PI (Causal relationship 2). Language disorders and psychiatric disorders can also be seen as standing side by side and interacting, whereby cause and effect between the two disorders are not clear; this results in a dependent comorbid existence (LI ↔ PI) from the start (Causal relationship 3) (Cantwell and Baker, 1985; Yule and Rutter, 1987; Prizant et al., 1990; Melamed and Wozniak, 1999; Westby, 1999).

In our attempt to describe these different relationships (Table 2.1), we have separated language impairments (LI) from psychiatric impairments (PI). We make no assumption about the importance of the one in relation to the other. Furthermore, in order to get insight in the etiology, the emergence of the disorders is extrapolated on an abstract time scale. Time 1 refers to the initial stage before the emergence of a disorder. At this point in time one or more third risk factors might increase the chance for a child to develop the one or other disorder. In Table 2.1, these risk factors are placed between brackets, because they are not always detectable (due to insufficient assessment procedures) or they have not yet been detected (due to lack of time and resources). Some of the theories we will discuss include third risk factors in their explanation of the emergence of one or both disorders, while others do not. Time 2 refers to the emergence of one of the two disorders we are focussing on or both. At Time 3 the other disorder appears as a result of the first, resulting in the comorbidity of both disorders in the end. Causal relationship 3 differs from 1 and 2 in that no unicausal direction relationship exists between LI and PI. Within causal relationship 3 LI and PI are seen as standing side by side and interacting, whereby cause and effect are not clear. They have a mutual influence due to multiple interconnected causal processes (Cohen et al., 1998a; Prizant, 1999). In
consequence, both disorders are assumed to start to develop more or less at the same time (Prutting and Kirchner, 1983; Yule and Rutter, 1987; Crittenden, 1996).

**Third risk factors**
Here we will briefly describe possible third risk factors, making a distinction between factors within the child and factors related to the environment. Factors within the child are sex and temperament of child, genetic abnormalities and neurological disorders; factors related to the environment are psycho-social stress factors. On the basis of research in this area, it has been claimed that only a combination of third risk factors will lead to the emergence of LI and PI (Bishop, 1997); no single factor will be sufficient.

From the developmental literature, it is known that a higher occurrence of language as well as psychiatric disorders is found in boys than in girls (Morrison and Anders, 1999; DSM-IV-TR, APA, 2000; Rutter and Taylor, 2002). This may well be related to genetic abnormality and environmental factors. Recently, a different developmental pattern was described for girls as opposed to boys: with age the psychiatric disorders decrease relatively more quickly in girls than in boys. Furthermore, aggressive behaviour in two-year-old boys proved to be a predictor for later externalizing disorders as opposed to girls in which aggressive behaviour at an early age proved to be a factor that can protect these girls for developing internalizing disorders (Mesman and Koot, 2002).

The child's temperament might intensify or mitigate the effects of language and psychiatric deficits (Mesman and Koot, 2002). For example, introversion might be negatively related to initiative-response patterns in communicative interaction and shyness might be related to anxiety disorders (Van Leeuwen et al., 1988; Lavigne et al., 1996).

A genetic abnormality may diminish the functional capacities that underlie linguistic and other social-cognitive processes, which in turn might cause a child to develop LI or PI or both (Tannock, 1998; Donahue et al., 1999; Griffith and Ripich, 1999; Melamed and Wozniak, 1999; Prizant, 1999). Genetic abnormalities can be located on different loci on certain genetic strings in the human DNA, for example the recently located 'FoxP2 language gene' (Kai, Fisher, Hurst and Vargha-Khadem, 2001; see for a critical discussion: Vargha-Khadem, Watkins, Alcock, Fletcher and Passingham, 1995). A genetic factor might underlie all language disorders in general (Gopnik and Crago, 1991; Rice, 1996; De Jong, 1999; APA, 2000:58-64; Bishop, 2001), or be specifically responsible for the specific language disorders found in SLI-children (Van der Lely, 1993, 2002). Until now, language disorders have not shown such a clear familial aggregation as some specific psychiatric disorders. The following psychiatric disorders are said to show a substantial family loading: schizophrenia, autism, emotional disorders (depression and general anxiety) and behavioural disorders (oppositional/defiant or conduct disorder) (Rutter and Taylor, 2002). Although familial aggregation suggests that a genetic factor increases the risk of language and social-cognitive impairment, the genes responsible for these impairments still have to be located.
Neurological disorders are often viewed as the underlying cause for sensory integration disorders (e.g. Ayres, 1979) and more general information processing disorders that increase children's chance to develop LI or PI or both (Cantwell and Baker, 1991; Bishop, 1997; Cohen et al., 1998a; Donahue et al., 1999; Griffith and Ripich, 1999; Melamed and Wozniak, 1999; Prizant, 1999). From the age of two/three, disorders in sensory information integration can be measured with the standardized Motoric Observation (e.g. Ayres, 1979; Wilbarger and Wilbarger, 1991). From the age of four, more general information processing disorders can be measured. Low IQ scores (IQ < 70) in children automatically indicate information processing disorders, often referred to as mental disorders. Some neurological disorders are related to a genetic predisposition, whereas others are caused by prenatal drug or alcohol abuse of the mother, perinatal trauma (e.g. anoxia or preterm birth), postnatal trauma (head injuries, infective diseases, non-inherited metabolic disorders) or exposure to environmental toxins. These information processing disorders are regularly observed in populations of language disordered children (Bishop and Mogford, 1988; Nelson, 1993), psychiatrically disordered children (Cantwell and Baker, 1980; Gualtieri et al., 1983) and in both psychiatric and language disordered children (Bishop, 1997; Griffith and Ripich, 1999). In general, it is assumed that the lower the IQ, the more language and social-cognitive impaired the children may be. However, there are language and psychiatric disorders that are not associated with low normal functioning (IQ-scores between 85 to 100) or borderline intellectual functioning (IQ-scores between 71 to 85) (Goorhuis and Schaarlaekens, 1994; APA, 2000).

Psycho-social stress factors are third risk factors in the child's environment (e.g. Mesman and Koot, 2002). They are called stress factors, because life stress might negatively influence conditions for development. However, it has not been possible to find literature where the influence of such stressors on learning is explained in detail. It could be the case that these stressors take away time and energy from the child as he copes with negative experiences. The child might then be less open or positive towards new stimuli and learning situations. Thus, stressors might facilitate the development of LI and PI (Van Leeuwen et al., 1988; Cantwell and Baker, 1991; Donahue et al., 1999; Prizant, 1999; Rutter and Taylor, 2002). Examples of such stressors may be a lack of parental warmth, inadequate parental supervision (e.g. too high demands), parental divorce, frequent change of residence, family conflict, discord and hostility; family illness or loss; hospitalisation, foster-home placement, expulsion from school/home; being teased at school/home, being deprived of food, freedom of movement, or of communicative interaction.

However, in language and/or psychiatrically disordered children only specific stressors have been found to increase the risk of developing the disorders, such as living in a family with lower social economic status (SES) (e.g. Giddan, Milling and Campbell, 1996; Lavigne et al., 1996), living in a single parent (mother) household (Cantwell and Baker, 1991; Cohen et al., 1993; Lavigne et al., 1996), living with a depressed mother (Richman and Stevenson, 1977) or a less well educated mother (Baker and Cantwell, 1982b; Cohen et al., 1998a), or living in a large family (Richman and Stevenson, 1977). However, other research reports contradictory
results. For example, Beitchman, Hood and Inglis (1990) and Cohen and colleagues (1998a) did not find that a lower SES increases the risk for the emergence of LI and/or PI. Systematic investigation in different subpopulations is still necessary to measure the effects of third risk factors alone or in combination, since the negative influence of some third risk factors is not always clear. In this respect, the onset time and the duration of exposure to a third risk factor might be important. Additionally, possible protective environmental circumstances, such as a profitable educational environment, might diminish their negative effect (Prizant et al., 1990; Donahue et al., 1999).

2.3 Theories about linguistic and social-cognitive development

Although some theories focus more on development than others, they all contribute to our understanding of linguistic and social-cognitive development (see Table 2.2). First, Executive Function Theory and Central Coherence Theory both try to explain changes in development by making information processing mechanisms central prerequisites for development in general. They are therefore called 'theories based on prerequisites' (see 2.3.1). Modularity Theory, Principles and Parameters Theory and Connectionist Theory all assume a strong genetic component; these are called theories from the inside-out (see 2.3.2). Conversely, Constructivist Theory, Social Interactionist Theory, Functional Theories and Theory-of-mind Theory emphasize that (linguistic) interaction with the environment predominantly shapes development in general; these are called theories from the outside-in (see 2.3.3).

<table>
<thead>
<tr>
<th>Theories based on prerequisites</th>
<th>Theories from the inside-out</th>
<th>Theories from the outside-in</th>
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<tbody>
<tr>
<td>Executive Function Theory</td>
<td>Modularity Theory</td>
<td>Constructivist Theory</td>
</tr>
<tr>
<td>Central Coherence Theory</td>
<td>Principles and Parameters Theory</td>
<td>Social Interactionist Theory</td>
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<td></td>
<td>Connectionist Theory</td>
<td>Functional Theories</td>
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<td></td>
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<td>Theory-of-mind Theory</td>
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In each subsection covering a specific theory, we will not focus on placing the theory in a historical perspective nor describe how theories might be related to one another and built upon each other. Rather, we will start with a short critical overview of the most important explanations of typical and atypical development and how these contribute to the comorbidity issue. More specifically, we will describe which causal relationship of the comorbidity of LI and PI is most favoured by a specific theory. If possible, we will present empirical data that confirm the existence of such a causal relationship between LI and PI – as proposed and explained by the theory – in specific populations of disordered children.
2.3.1 Theories based on prerequisites

Executive Function Theory (Pennington and Ozonoff, 1996; Tannock, 1998; Westby, 1999) and Central Coherence Theory (Frith and Happé, 1994) both assume that deficits in central information processing mechanisms – possibly based on underlying neurological and/or genetic abnormalities – increase the risk for developing language and psychiatric disorders.

Executive Function Theory

Within Executive Function Theory the possible influence of executive functions on development in general is explained. Executive functions refer to the partly innate (meta)cognitive information processing mechanisms. Exactly what these mechanisms are is still subject to debate. Traditionally, Attention and (short-term) Memory have been postulated as executive functions (e.g. Pennington and Ozonoff, 1996). Motivation is added here on the basis of Trevarthen and Aitken (2001). They proposed the existence of an innate, Intrinsic Motive Formation (IMF) responsible for a new-born infant being orientated towards human stimuli and being highly sensitive to receive sensory-motor and language information. This motivator system may be a prerequisite to be able to imitate and to learn human signals, especially language. This results in the triad Motivation, Attention and (short-term) Memory (MAM) that might mutually influence each other (e.g. Elbers and Van Loon-Vervoorn, 1998). Leonard (1998) suggests that Specific LI is the result of a limitation on information-processing capacity, such as through restrictions on memory 'space', 'energy' for task completion and processing 'time'. The limited processing capacity may account for many difficulties in language and social-cognition, but cannot provide explanations of the exact nature of LI and/or PI.

In the developmental literature, executive functions were initially almost exclusively related to children's school achievements. Recently, the executive functions, especially MAM, are seen as prerequisites to perform a behavioural task in a goal-oriented way, such as making a plan. This plan is a mental representation of the behavioural task and involves sequencing, anticipating and hierarchical organizing. From birth on, executive functions improve and therefore planning capacities increase with age. Between five to eleven years, children learn to develop planning strategies, to conceptualize the domains that can be planned and the consequences of different planned tasks (Kail, 1984; Kreitler and Kreitler, 1987).

Language plays an important role within Executive Function Theory. At the age of three to five years, children develop a self-regulatory capacity, mainly by the use of internalized language. They learn to inhibit initial immediate responses (i.e. response inhibition) in favour of goal-oriented behaviour (Eslinger, 1996; Barkley, 1997; Rogers-Adkinson and Griffith, 1999). By the use of inner language, children can also learn to solve cognitive and social problems effectively, that is when their desires or needs differ from those of the environment. However, children stay goal-oriented not only by using inner language, but also by verbal negotiation and verbal instruction given by caregivers, teachers and playmates. The language used keeps children oriented towards specific goals and holds them motivated to execute those step-by-step actions necessary to achieve a certain goal.
Language not only helps in the development of executive functions, but conversely language development itself is dependent on the development of MAM.

Motivation, Attention and Memory (MAM) are necessary in order to establish joint attention, the ability to maintain sustained visual attention focused on a certain entity (person, animal or object), situation or event. Simultaneously, children receive related language input in reciprocal communicative interaction that enables them, for example, to name entities, situations and events. MAM is also involved in identifying, recognising and storing of more complex language information (Love and Thompson, 1988; Cohen et al., 1993). For example, the planning, organisation and monitoring of extended stretches of language, such as discourse and narratives, places heavy demands on all three of these executive functions (Westby, 1999).

Deficits in Motivation, Attention and Memory, probably caused by genetic and/or neurological abnormalities, negatively affect goal-oriented behaviour. This is set out in the Executive Dysfunction Theory (e.g. Frith and Happé, 1994; Russell, 1997; Happé et al., 2001). For example, when children are less motivated to engage in communicative interaction, they are more at risk to develop language and psychiatric disorders. They elicit responses from caregivers that are less frequent and less positive than normally developing children do. This results in less (positive) language and social-cognitive input, which in turn might contribute to the emergence of both disorders (Prizant et al., 1990; Greenspan, 1992; Westby, 1999). MAM dysfunctioning might also cause a poorly developed self-regulatory language function. This could mean that children become less organized and effective in cognitive and social-problem solving, resulting in learning disorders and poor school achievements (see also 1.3.4). A poorly developed self-regulatory language function might cause externalizing psychiatric disorders in particular. When children are not able to use the self-regulatory language function to inhibit undesired behaviours, impulsive or aggressive behaviour could result. This emotional and behavioural dysregulation can be diagnosed as a psychiatric disorder if it is frequent enough (Van Leeuwen et al., 1988; Cohen et al., 1998a).

Executive dysfunctioning can cause poorly developed self-regulatory inner language (LI) that in turn, following this chain of reasoning, can cause emotional and behavioural dysregulation (PI), thus (LI → PI). MAM dysfunctioning can also directly cause impulsive behaviour. This, in turn, can negatively influence the development of the ability to establish joint attention necessary for learning language. Here, executive dysfunctioning causes emotional and behavioural dysregulation (PI) that in turn can cause a language disorder (PI → LI). We have shown here that Executive Function Theory predicts: LI → PI → LI etc. in a continuing causal chain. Notwithstanding the fact that the time-interval between both disorders remains unclear, this causal relationship might be best depicted by a two-way arrow (LI ↔ PI), reflecting that both disorders are interrelated from the very beginning.

Empirically, executive dysfunctioning is frequently found in children with SLI. In fact deficits in (auditive) short term memory or in the information processing of
hierarchical relationships are assumed to be a possible cause for the emergence of specific LI (e.g. Gathercole and Baddeley, 1990; Johnston, 1992; Tannock and Schachar, 1996; Tannock, 1998; De Jong, 1999).

Executive dysfunctioning is also observed in psychiatrically impaired children, mostly with externalizing disorders. First, in children with impairments on the autistic spectrum the Motivation to engage in social interaction is affected (e.g. Frith and Happé, 1994). MAM dysfunctioning in autistic children is related to disorders in response inhibition (being unable to delay or inhibit responses), in flexibility, in self-reflection and in monitoring, all necessary for goal-oriented behaviour, but MAM is also related to disorders in language (Baron-Cohen, Leslie and Frith, 1985, 1986; Johnston, 1985; Baron-Cohen, 1995; Pennington and Ozonoff, 1996). Second, MAM dysfunctioning is also frequently found in children with ADHD. In this subpopulation, Attention deficits are especially related to language and psychiatric disorders involving goal-oriented behaviour (Westby and Cutler, 1994).

Finally, executive dysfunctioning can also be observed in children with internalizing psychiatric disorders, such as Childhood Depression or Anxiety Disorders (APA, 2000). In these children emotional disorders can frequently evoke conflict situations, placing heavy loads on emotional processing of these negative experiences. This, in turn, may slow down or disrupt other mental activities such as the executive functions involved in information processing (e.g. Williams, Watts, MacLeod and Mathews, 1988; Bishop, 2002).

In sum, we argue that Executive Function Theory predicts that executive dysfunctioning will increase the risk for the emergence of both disorders. Furthermore, the direction of the comorbidity of LI and PI is best depicted by a two-way arrow (LI ↔ PI): both disorders are interrelated from the very beginning.

Central Coherence Theory

Central-Coherence Theory is defined as the ability to integrate perceptual information into a coherent whole (Frith, 1989; Frith and Happé, 1994; Jarrold and Russell, 1997; Happé, 1999, 2001; Van Berckelaer-Onnes, 2002). Children are born with a natural drive to integrate what they experience into a meaningful entity; this applies both to the language and the social-cognitive information they receive. 'Coherency' as an information processing mechanism could in our opinion be added to the other executive functions Motivation, Attention, and Memory, since Coherency is also a prerequisite for goal-oriented behaviour. Furthermore, the triad Motivation, Attention and (short-term) Memory (MAM) might mutually influence and determine Coherency. For example, when children are only motivated to attend to small differences instead of similarities, meaningful, coherent generalizations cannot be made.

Similar to executive dysfunctioning, Coherency dysfunctioning has a negative impact on developmental change in general. This means that language or social-cognitive information cannot be integrated into a coherent whole, but is perceived in rather fragmentary way. The anticipation and the organisation of goal-oriented tasks is even impossible in the most severe cases.
Empirically, Coherency dysfunctioning can be observed in language impaired children: they reveal, for example, deficits in causal reasoning, necessary to produce a coherent text (Bishop, 2002). Coherency dysfunctioning is also observed in psychiatrically impaired children, especially in autistic children. Empirical data show that these children perceive daily life experience in a fragmentary way and are therefore disturbed in acquiring general goal-oriented social-cognitive and language skills. Even the integration of linguistic and non-linguistic gestures, such as reaching and eye-gaze, used in early communicative goal-oriented interaction seems to be a difficulty in many autistic children (Van Berckelaer-Onnes, 2002). By comparing both groups of disordered children, it becomes clear that Coherency dysfunctioning might differ in severity: from relatively mild in LI-children to relatively severe in autistic children, affecting overall development.

In sum, Central Coherence Theory predicts that Coherency dysfunctioning causes both disorders. It is not yet clear, however, from the formulation of the theory what it might predict about the relationship between LI and PI.

In the future, Executive Function Theory and Central Coherence Theory should be integrated and developed into a more complete theory. The interrelationships between all possible executive functions that are involved in the development of general information processing should be explored, including Motivation, Attention, Memory and Coherency. In the future, we think that even Relevance might be put forward as being yet another (partly) innate, executive information processing mechanism (e.g. Sperber and Wilson, 1986). For example, explicitness and transparency in fine-tuned language and social-cognitive behaviour is based on aiming at Relevance (see 12.2 to 12.8).

2.3.2 Theories from the inside-out
Theories from the inside-out are Modularity Theory, Principles and Parameters Theory and Connectionist Theory. In their most recent versions, these theories share a basic assumption: changes in development have a genetic component (e.g. Braine, 1994).

Modularity Theory
In Modularity Theory, it has been assumed that an innate language module1 exists separately from other cognitive modules (emotional/social development is ignored) and that they operate independently from each other (Fodor, 1975, 1983). Some interdependence between the modules has been added in later work (e.g. Karmiloff-Smith, 1992). Different language submodules/domains have been identified, such as the phonologic, morphological, syntactic, semantic and pragmatic modules. This assumption is now widely used and accepted (McTear and Conti-Ramsden, 1992; Jackendoff, 1997). Even microdomains have been differentiated within a certain subdomain, such as one for 'linguistic reference’ within semantics/pragmatics (Karmiloff-Smith, 1992).

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1 'Module' refers to a specific location in the brain, as opposed to 'domain' that refers to the cognitive representations and actions in the mind that are located within a specific module (Karmiloff-Smith, 1992).
Chapter 2

From a modular perspective, which claims the existence of an independent language module, children can be impaired in the language domain, whereas other social-cognitive domains stay intact or vice versa. However, recent empirical evidence from different groups of disordered children does not confirm this assumption. For example, children with Down's Syndrome are found to have more across-the-board domain-general deficit in cognitive processing (Karmiloff-Smith, 1992; Miller, 1996). SLI-children have been found to have not only exclusively language disorders, which has been claimed for a long time, but also language deficits in the semantic-pragmatic domain (Fujiki and Brinton, 2002). Children on the autistic spectrum not only show mild to severe social-cognitive deficits, but also language deficits in the semantic-pragmatic domain (Bishop, 1997). Children with William's syndrome have been found to have difficulties in the cognitive subdomain related to spatial knowledge and this is reflected in the impaired use of spatial terms in language (Pléh, Lukács, Racsmány and Kovács, 2002).

With respect to language growth, some researchers suppose that the subdomains within the language domain give input to each other and that this input causes language development on the basis of general cognitive learning procedures. This is referred to as semantic, syntactic and pragmatic bootstrapping. First, semantic bootstrapping enables the child to use semantic notions as evidence for the presence of grammatical entities. For example, noun-words trigger different morphological/syntactic rules as opposed to verb-words (Pinker, 1984, 1989). Second, syntactic bootstrapping enables the child to use syntactic information to predict the meaning of words (Gleitman, 1990). Last, pragmatic bootstrapping enables the child to use information about the pragmatic function of words (their relevancy in communicative interaction) in order to differentiate between morphological/syntactic rules, independently from the meaning of those words (Van Kampen, 2000, 2001). All proposals of such bootstrapping mechanisms suggest that language domains are designed in such a way that information developed within one domain can be the input to development in another domain.

Although Modularity Theory does not explicitly contribute to the comorbidity issue, the proposed theoretical ideas about bootstrapping suggest that disorders in one language subdomain will affect other language domains in disordered populations. Following this chain of reasoning, it will be unlikely that only a morphological/syntactic or semantic/pragmatic disorder can be found in PI-children with different types of psychiatric disorders (Cohen et al., 2000; see 1.3.3). Empirical evidence in disordered populations other than the psychiatrically impaired supports this idea. For example, in children with Down's Syndrome morphological/syntactic and semantic/pragmatic aspects of language acquisition have both been found to be delayed (Parigger and Baker, 2002). However, according to the original assumption of strict modularity, language subdomains might also be partly independent in their functioning, since in children with William's Syndrome more semantic than morphological/syntactic disorders were found (Thomas, Dockrell, Van Duuren, Messer, Parmigiani and Karmiloff-Smith, 2002).
Thus, the language module seems more interrelated to the social-cognitive module than originally claimed by Modularity Theory, probably even in some of its language and social-cognitive subdomains. Although Modularity Theory does not explicitly contribute to the comorbidity issue, empirical data suggest that disorders in the language module and social-cognitive modules must frequently co-occur in disordered populations. Modularity Theory predicts that, although development is partly domain-specific, both language (LI) and social-cognitive (sub)modules (PI) are frequently simultaneously affected caused by domain-general learning deficits. However, the direction of the causal relationship of the comorbidity of LI and PI is not accounted for.

**Principles and Parameters Theory**

In Principles and Parameters (P&P) Theory (Chomsky, 1981, 1995), it is assumed that humans are genetically predisposed to learn language. First, children are not only equipped with an innate set of universal principles that are fixed (unchangeable) and applicable to every language, but also with innate parameters. These provide a child with a limited number of options for particular aspects of language, such as word order. They will be set by the child on the basis of language input (Roeper and Williams, 1987; Clahsen, 1992; Pinker, 1994). Like Modularity Theory, P&P Theory also assumes a separate syntactic module. Within this theory the acquisition of morphology and syntax has been worked out in great detail (e.g. Hyams, 1992; Chomsky, 1995). Some P&P researchers also relate the syntactic module to other language areas. Semantic development is seen by some as an important drive for syntactic development (Jackendoff, 1983; Clahsen, 1992; Pinker, 1994). Recent research in this framework has explored how the pragmatic function of language use triggers specific syntactic forms (Hollebrandse, Roeper and De Villiers, 1999; Van Kampen, 2001).

P&P Theory has been applied to normal language development and also to children with language disorders. Evidence from children with SLI shows that language rules are frequently violated, especially in inflectional verb and noun morphology resulting in morphosyntactic disorders (see De Jong, 1999). However, disorders in morpho-syntax in this group of children seem to be relatively infrequently related to disorders in other language areas, such as semantics/pragmatics. P&P Theory does not explicitly predict that PI can cause LI, restricted to the formal aspects of the language system. The strongest claim is that PI should have no effect on language development at all (Mills and Tso, 1991). If it is assumed that children learn language-specific rules over time triggered by the language input (Wexler and Manzini, 1987; Felix, 1992), then input that is different in some crucial aspects could negatively affect the possibility to learn the target language. Although the input to PI-children has not yet been explored, it might be quite different from the input normally developing children receive. For example, children with ADHD might receive relatively many commands focussed on the regulation of non-cooperative behaviour (e.g. 'sit still'; 'stop it'). Following this chain of reasoning, PI-children might evoke different input that can cause LI.
If it is assumed that language rules become available in an ordered way over time triggered by an innate maturation program (Borer and Wexler, 1987; Roeper and Williams, 1987), the speed of syntactic developmental growth might well be determined by the general speed of maturation of the child (Mills and Tso, 1991). Slow maturation would not only cause language delays but must also affect social-cognitive growth (Ruhland, 1998). It is very unlikely that slow maturation would exclusively cause morphological/syntactic disorders; semantics/pragmatics would also be affected.

In sum, only if a maturation program is assumed, P&P Theory suggests that LI might exist alongside a PI. However, since morphological/syntactic disorders are never related to disorders outside the language domain, such as psychiatric disorders, P&P Theory makes no predictions about the comorbidity between LI and PI.

**Connectionist Theory**

Connectionist Theory focusses particularly on language and cognitive information processing (McClelland and Rumelhart, 1986; Rumelhart and McClelland, 1986; Smith, 1996). According to this theory, children are thought to be innately predisposed to learn language and other non-social cognitive skills on the basis of the input (e.g. Seidenberg, 1994; Elman, Bates, Johnson, Karmiloff-Smith, Parisi and Plunkett, 1996; Plunkett, Karmiloff-Smith, Bates, Elman and Johnson, 1997; Bates and Elman, 2002). Social-cognitive development, especially emotional development, falls outside the scope of this theory (e.g. Smith, 1996).

Connectionist Theory searches for explanations of development in general using computer simulations based on neural networks. When applied to language, for example, specific learning tasks, such as sentence comprehension or question answering, are studied as to how they are learned on the basis of language input. The language information processing system is constantly adjusted in order to become consistent with the language evidence from the input. Language acquisition also occurs when children use language evidence from their own output, being recursively used as input. The connective patterns that are triggered most frequently by the input become most consistent, and therefore win the competition (Bates and MacWhinney, 1987). Variation in language abilities within and across cultures is assumed to be a result of varying input experiences.

Connectionism says nothing about the relationship between language and other cognitive domains. The theory does not exclude social, communicative interaction but since it works with neural networks there has to be an assumption of connections between these areas. This is not made explicit. Conversely, Connectionist Theory explicates that self-organizing language and other cognitive information processing systems exist, developing from small and simple to larger and more complex over time. In reality, small and gradual internal changes in these systems can lead to huge non-linearities observable in overt language and other cognitive behaviour (e.g. Van Geert, 1995; Ruhland, 1998). The connection information networks are not only activated at many levels at the same time, but also simultaneously connect information in a hierarchical way (e.g. Bates and MacWhinney, 1987; Clark, 1989;
Empirically, language and some aspects of cognitive information processing are explored in adults and children with brain damage (e.g. McClelland et al., 1995; Smith, 1996; Plunkett et al., 1997; MacWhinney, 1998). Early damage of connections between information units is observed to be less severe than later damage, since initially connections are smaller in number and more flexible than later, more fixed connections. It is also found that the greater the damage was, the greater was the degree of degradation in performance, which might even be progressive in character. It was also explored how the computer simulation system copes with executive dysfunctioning limited to a restricted working memory. This proved to influence language learning negatively. Executive dysfunctioning in Motivation, Attention and Coherence was not explored (see 2.3.1), since Connectionist Theory does not relate disorders in the social-cognitive domain to disorders in language. Although this theory describes language and some aspects of cognitive development based on similar information processing systems, no explicit predictions are made about the comorbidity of LI and PI. This falls outside the theory its scope, comparable to the other two inside-out theories presented earlier.

### 2.3.3 Theories from the outside-in

Theories from the outside-in are Constructivist Theory, Social-Interactionist Theory, Functional Theories and Theory-of-Mind Theory. These theories put emphasize on developmental change as the result of what is learned on the basis of experience.

#### Constructivist Theory

Constructivist Theory of Piaget (1952, 1959, 1970a, 1970b, 1971) explains how the child constructs a meta-social-cognitive information processing system based on experience; the ability to do this is presumed to be innate (see for a critical review Bates, Thal and Janowsky, 1992; Karmiloff-Smith, 1992; Bates and Elman, 1996, 2002). Within this theory the (language) information received from the environment is generated by the child as an active learner, starting with the imitation of language and other social-cognitive behaviour. Children are thought to be constantly organizing information on the basis of the available input into mental representations that represent their experiences, and simultaneously organizing these representations into hierarchically ordered systems.

Piaget (1952, etc.) underestimates the status of language. However, the description of how mental representations become more complex during social-cognitive stage-bound development is applicable to language development: the actual world is often represented by language representations. With age children change their language behaviour from simple language representations to higher forms of logical reasoning. This type of reasoning was first described by Piaget. Thus, continual increase in the complexity of language is a result of active construction, and not a gradual unfolding of predetermined forms that mature with age.

However, in most of Piaget's work, language behaviour was seen solely as a product of general changes in the child's social-cognitive behaviour. Therefore, language
development is often described as embedded in age-related stages of social-cognitive development, whereby each stage is to be successively built on its precursors. This is a debatable assumption on the part of Piaget but it has been put forward by many researchers in the field of psychology, psychiatry and psycholinguistics (e.g. Hulit and Howard, 2002).

Although Piaget does not explicitly address disordered or delayed development, we can infer, following this assumption, that social-cognitive disorders must necessarily include language disorders or delay, since language is seen as part of social-cognition.

Thus, although no empirical data are available, this Constructivist Theory would predict that both LI and PI can co-occur and usually will. The causal relationship of the comorbidity of LI and PI would be one of inclusion, whereby PI automatically includes LI (e.g. Goorhuis and Schaerlaekens, 1994). The comorbid relationship might be best depicted by a unicausal direction (PI → LI).

Social-Interactionist Theory

In contrast to Piaget, in Social-Interactionist Theory Vygotsky (1976, 1986 and earlier) assumes that language use in affective, social interaction triggers social-cognitive development in general, based on underlying innate, general learning capacities.

Vygotsky emphasized the role of language, and especially the role of inner language, as the carrier of inner thoughts. He assumed that by inner language all types of overt behaviour could be intrinsically motivated and controlled. Additionally, verbal negotiation and instruction are assumed to be extremely influential on social-cognitive development. For example, by verbal guidance of adults or more capable peers children develop from their actual developmental level of independent problem solving to the level of potential development. The distance between these two levels is known as the Zone of Proximal Development.

Vygotsky sees linguistic interaction as part of a much wider socio-cultural experience. Since the nature of social interaction varies across cultures, changes in language development that guide social-cognitive development vary widely across cultures. This idea implies that children start to learn language rules that are language specific and culturally specific from the beginning (Bruner, 1986; Vygotsky, 1986).

Junefelt (1990) applied the framework of Vygotsky to the development of subjectivity and intersubjectivity, in which language also plays a crucial role. The so-called ability of subjectivity implies that infants learn to master the difficulties of relating objects and situations to themselves and learn to predict the consequences of their own general behaviour, involving the active use of inner language. The development of ideas about other persons' consciousness and intentionality and applying these ideas in interaction is called intersubjectivity (Trevarthen, 1979; Trevarthen and Aitken, 2001). Intersubjectivity also involves the ability to coordinate the understanding of other's thoughts, feelings and desires that might be (partly) in conflict with children's attempts to balance inner needs with external demands – and vice versa –, also called social problem solving (Selman and
The causality of comorbidity

Demorest, 1984; Yeates, Schultz and Selman, 1991a, 1991b). In order to develop these two abilities, children need caregivers that are emotionally fine-tuned in interaction, willing to teach their children about inner feelings, desires and needs. Later, (inter)subjectivity is also learned by the use of inner language and dialogue, both regulating behaviour called self-control (Frith, 1989; Hobson, 1993; Baron-Cohen, 1995).

Vygotsky (and Junefelt) do not explicitly contribute to the comorbidity issue (but see Vygotsky, 1986:232 and further), but the proposed theoretical ideas suggest that abnormal affective communicative linguistic interaction negatively influences the development of (inter)subjectivity by means of internalized language and dialogue necessary for self-regulation and control (Cohen et al., 1998a). Empirically, such impaired developmental patterns have been frequently observed in psychiatrically disordered children, such as autistic children (Vygotsky, 1986; Van Berckelaer-Onnes, 2002), children with schizophrenia (Vygotsky, 1986) and ADHD (Trevarthen and Aitken, 2001).

Thus, Social-Interactionist Theory, assuming that social-cognition is guided by language development, would predict that both disorders can co-occur and mostly do, and the causal relationship of the comorbidity of LI and PI is thought to be one of inclusion, whereby LI automatically seems to include PI. Cohen and colleagues (1998a) argue this relationship might best be depicted by a unicausal direction (LI → PI).

Functional Theories

Since no single overall functional theory exists, but many different theories focus on the communicative function of language, we describe functional ideas under the heading of Functional Theories. In these theories language is conceptualized as an instrument of social interaction, used with the intention of establishing communicative relationships and the transmission of information (Brown, 1973; Bruner, 1976; Craig, 1983; Dik, 1989; see for an overview Van Balkom, 1991; McTear and Conti-Ramsden, 1992). Furthermore, language is learned in interaction on the basis of language input that is thought to be highly structured and adapted to the level of language functioning of the child (e.g. Newport, Gleitman and Gleitman, 1977).

Functional Theories focus on the effective use of language and linguistic information exchange in context. Accordingly, it is assumed that language use influences the language content and (in turn) the morphological/syntactic form (Sperber and Wilson, 1986; Dik, 1989). Thus, these theories reject strict modularity (see 2.3.2) that implies only domain-specific language learning. Rather, language development is seen as a complex and multifaceted system intertwined with social-cognitive development (e.g. Snow, 1996). It is emphasized that language (e.g. verbal interaction and instruction) is an important mediator for social-cognitive learning. For example, children only learn to name objects after they have heard others name them. Accordingly, individual variation in language skills might be explained, among other things, by the received verbal information related to daily experience that differs among individuals.
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Empirically, from a functional perspective on language disorders, different ideas have been put forward on the influence of disorders in language use on social-cognitive development. First, the learning of the rudiments of communicative language use, exchanging information by turn, is assumed to occur in conjunction with the separation-individuation process in the young child. It is suggested that disorders in communicative language use in young children (below the age of one year) might disturb the separation-individuation process and the development of a sense of self later in time. When severe enough, this might be diagnosed as an important characteristic of psychiatric disorder (Love and Thompson, 1988).

Second, as the language impairment is characterized by frequently not understanding verbal messages of others and not being understood by others in verbal interaction, many instances of miscommunications might lead to a distortion of a child's basic mood. They might develop permanent feelings of impatience or feelings of frustration, fear, anger and sorrow (Silva, Williams and McGee, 1987; Beitchman et al., 1990; Goorhuis and Schaerlaekeens, 1994). When children are impaired in talking about these feelings, this might increase the chance of developing externalizing (e.g. destroying things and relationships) and internalizing (e.g. being withdrawn from interaction; self-abusive behaviour) psychiatric disorders over time (Prizant et al., 1990).

Third, when children show problems following verbal instructions, they might not be able to react as expected, causing parents to behave differently with these children than with normally developing peers. This interaction might be negatively affected by subtle or more severe feelings of aggression in caregivers that lead to an avoidance of interaction, and feelings of anxiety that might lead to overprotection. Frequent failures in following verbal instructions might be extremely damaging for the child when the environment reacts extremely negatively, such as in case of maltreatment and child abuse (Love and Thompson, 1988).

Fourth, language disorder might cause children to participate in less positive social interactions, to converse less often with peers during (non-)play activities, to be less involved in organizations and non-sport activities, and to be less successful in social bids, less directive and less integrated in play groups than the children without language disorders. However, symbolic play and playing with peers are thought to be a very important playground for overcoming fears and for processing important life events (Guralnick, Connor, Hammond, Gottman and Kinnish, 1996). If language impaired children play less frequently and sophisticatedly with other children, this might indirectly increase their chance to develop a psychiatric disorder (Van Leeuwen et al., 1988). Since language disordered children can be considered less attractive playmates and are often not accepted into social groups (Rice, 1993; Beitchman et al., 1996; Donahue et al., 1999), this can also contribute directly to the development of a psychiatric disorder (Baker and Cantwell, 1987).

All these causal relationships in which LI increases the chance to develop PI have frequently been suggested by researchers. Language disorders can lead to a variety of social-cognitive deficits that might be so enduring that they cause psychiatric disorders over time (Prizant et al., 1990; Cantwell and Baker, 1991; Beitchman et
The causality of comorbidity

al., 1996; Cohen, 2000). When a disturbed interaction continues, both impairments might even become worse. This negative vicious downward spiral might have long-lasting negative effects on an individual's overall functioning, even into adulthood (Westby, 1999).

On the basis of empirical data, these causal relationships are frequently found to exist in populations of children with different types of semantic-pragmatic language disorders and psychiatric disorders, especially disorders on the autistic spectrum (Bishop and Rosenbloom, 1987; Rapin and Allen, 1987). However, empirical data also show that the same causal relationship might exist between LI and PI in children with language disorders, including morphology/syntax, and with psychiatric disorders not limited to the autistic spectrum, but included different externalizing and internalizing disorders (e.g. Cantwell and Baker, 1991; Beitchman et al., 1996; Cohen et al., 1998a, 2000). Functional theories seem to predict that the direction of the causal relationship of the comorbidity of LI and PI is unicausal in character, best depicted by a one-way arrow (LI $\rightarrow$ PI).

Theory-of-mind Theory
ToM Theory describes and explains how children internally construct a lay theory about social interaction, called their Theory-of-Mind. This largely involves the ability of 'mindreading': the ability to interpret other people's actions based on their presupposed goal-oriented intentions that are hidden in their minds. Such interpretations are necessary to come to a coherent, causal understanding of social interaction (Perner, 1991; Karmiloff-Smith, 1992; Wellman, 1992; Baron-Cohen, 1995; Baron-Cohen, Tager-Flusberg and Cohen, 2000). Some aspects of a Theory-of-Mind have been integrated into theories about language development (e.g. De Villiers, 2001a, 2001b).

Language development plays a central role in the development of a Theory-of-Mind. By means of language children learn to describe human action and interaction, and the underlying motivation and causality of such (inter)actions. Furthermore, through linguistic interaction, a child's ToM can be checked with the ToM of others, called 'reality testing'. This forms input to the child which helps ToM skills to develop.

Before age one, children preferentially attend language input related to human actions (i.e. joint attention) (Premack, 1990; Johnson and Morton, 1991). This enables them not only to build (language) representations about themselves (i.e. subjectivity), but also about others (i.e. intersubjectivity) (e.g. Frye and Moore, 1991) (see 2.3.3). From age two, they develop representations about other people's feelings and thoughts, called 'mental states', enabling them to exhibit emotions in response to others. From two to three years of age, children start to make representations about the relation between reality and representations of this reality; they start to understand that pictures are a representation of the real world.

By three years of age, they learn that knowledge is the product of perception (e.g. 'seeing leads to knowing'). They therefore show evidence of understanding what others know and understand, if this does not conflict with perceptual information. Once children begin to understand emotions as mental states (expressed by emotional verbs such as like, love, dislike, fear etc.), they realize that the same
situation can produce different emotions in different people (Baron-Cohen, 1988, 1995; Perner, 1991; Karmiloff-Smith, 1992; Wellman, 1992; Leslie, 1994; Westby, 1999). In the pre-school years, children even exhibit considerable awareness of how to affect mental states of others (Wellman, 1992; Rogers-Adkinson and Griffith, 1999). Meanwhile, they begin to pretend and to recognize the pretending of others, developing a notion of truth. In this period, language use in symbolic, imaginary play-activities, make-believe and group games are extremely important for developing a ToM (Premack, 1990; Baron-Cohen, 1995).

From age four to five, children start to learn that a communicative message always contains some subjectivity related to its messenger, expressed by the use of mental state verbs (e.g. think, know, hope, believe, pretend, remember, claim). Children learn that the sentence embedded in a mental-verb-sentence-frame does not necessarily entail the truth, realizing that people can hold false beliefs. Between age six and seven, they learn to use nested beliefs themselves (e.g. 'Paul thinks that Suzy thinks...') (Perner 1991; Karmiloff-Smith, 1992; Wellman, 1992).

School-aged children need to learn how to read another person's mind, such as volitional mental states (desires and goals) in order to interact successfully and to create meaningful social relatedness with others (Baron-Cohen, 1995). They must also learn to tie together their own and another person's mental state conditions into a coherent understanding, necessary, for example, to solve social conflicts (Cohen et al., 1998a). Also meta-representational, hierarchically ordering skills involved in ToM are believed to affect the way children can access and scan their own mental repertoire beyond the areas of currently activated content, called divergent thinking (Suddendorf and Fletcher-Flinn, 1997).

Empirically, in order to check specific delays or deficits in ToM, a series of experimental tests are used, such as the well-known false belief tasks (e.g. Wellman, 1992)². Less frequently, observations of language and social-cognitive behaviour are used to infer the underlying ToM (dis)abilities in children, and these are then often compared to the results on certain ToM tasks (e.g. De Villiers and De Villiers, 2002; Pérez-Pereira and Resches, 2002).

Little is known about what spontaneous language might reveal about children's ToM development. There exists, however, an unclear area of interrelatedness, as the mastery of linguistic abilities plays a central role in the emergence of ToM, especially the ability to reason about mental states. (e.g. Astington and Jenkins, 1999; De Villiers and De Villiers, 2002).

Recently, part of the domain specialized in ToM has been treated as modular, partly encapsulated, although still connected to other domains (Baron-Cohen, 1995). How the ToM domain itself is recruited by the language domains for their functioning has been explored (De Villiers, 2001a, 2001b; Hollebrandse, 2001). Within the field of morphology/syntax, for example, it is speculated that ToM insights are used to successfully apply reference rules, especially with respect to the use of determiners

² They always require language, and it is questionable therefore whether ToM tasks are reliable and lead to valid results (e.g. Van Berckelaer-Onnes, 2002).
The causality of comorbidity (Thrift, 2003) and sentence embedding (Hollebrandse, Roeper and De Villiers, 1999). For example, if the child has not yet developed that part of ToM that represents how another person's mental state might be motivating their actions, embedded sentences cannot be produced correctly. Within semantics/pragmatics, for example, it is investigated how ToM insights are necessary in order to successfully apply reference rules, especially with respect to the use of pronouns (Pérez-Pereira and Resches, 2002).

Researchers have indicated that language disordered psychiatrically impaired children often have severe ToM deficiencies (Cohen et al., 1998a, 1998b, 2000). This is explained by different assumptions about the causal relationship that underlies this comorbidity. We suppose that language disorders might frequently cause instances of miscommunication. A disturbed communication might, in turn, cause a delay in the development of joint attention, and of notions of subjectivity and intersubjectivity, necessary for the acquisition of certain ToM skills, such as the ability to take someone else’s perspective. Furthermore, we think that language disorders might negatively affect the ability to express social-cognitive knowledge. This can be observed when children express loosely connected mental associations and unclear causal reasoning that show underlying ToM impairments. Clear thinking and reasoning are especially important in learning and (social) problem solving (Harter, 1983; Schultz, Izard, Ackerman and Youngstrom, 2001; Bishop, 2002; Van Berckelaer-Onnes, 2002).

Language disorders might also negatively influence the quality of imaginary and pretend play, decreasing the chance for language disordered children to be involved in such games. As these games are thought to be necessary prerequisites for building ToM, a withdrawal from these games increases the chance for ToM deficiencies (Van Leeuwen et al., 1988).

Especially autistic children show language disabilities in expressing reality on the one hand and fantasy involved in pretend and imaginary play on the other (Frith, 1989; Blijd-Hoogewys, Serra, Loth, Van Geert and Minde, 2002). These autistic children were wrongly supposed to have only an impaired ToM module, also referred to as 'mindblindness' (Baron-Cohen, 1995), since the language domain was also clearly affected.

However, the Baron-Cohen study inspired many others to explore the development of ToM in children with other psychiatric disorders. Comparably, a (partly) disordered ToM was observed in children with schizophrenia (Corcoran, Mercer and Frith, 1995), with ADHD (Love and Thompson, 1988; Buitelaar, Van der Wees, Swaab-Barneveld and Van der Gaag, 1999), with anxiety or oppositional conduct disorders (Steerneman, 1994) and pervasive developmental disorders (Baron-Cohen, 1995). When ToM is disordered, children might rely less on this theory in everyday life experiences, increasing the risk for developing social-cognitive problems. If

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3 Children with IQ rates below 80 were also found to have ToM deficiencies, presumably based on executive dysfunctioning (Yirmiya, Erel, Shaked and Solomonica-Levi, 1998) preceding LI and PI (Table 2.1).
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this lasts long enough, it might lead to the emergence of PI. Thus, ToM Theory is thought to predict that the direction of the causal relationship of the comorbidity of LI and PI is unicausal in character, being best depicted by the one-way arrow: (LI → PI).

2.4 General conclusions and additional remarks

In Table 2.3, we summarize how the different developmental theories are thought to predict possible causal relations between language and psychiatric disorders: (1) PI → LI; (2) LI → PI or (3) (LI ↔ PI). Where a prediction can be made, a plus is inserted in the table.

Table 2.3 Inferred predictions about the direction of the causality of the comorbid relation between LI and PI

<table>
<thead>
<tr>
<th>Theories</th>
<th>Causal relationship 1</th>
<th>Causal relationship 2</th>
<th>Causal relationship 3</th>
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<tr>
<td></td>
<td>PI → LI</td>
<td>LI → PI</td>
<td>LI ↔ PI</td>
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<tr>
<td>Theories based on prerequisites</td>
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<tr>
<td>Executive Function Theory</td>
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<tr>
<td>Central Coherence Theory</td>
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<td>Theories from the inside-out</td>
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<tr>
<td>Principles &amp; Parameters Theory</td>
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<tr>
<td>Modularity Theory</td>
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<td>Connectionist Theory</td>
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<tr>
<td>Theories from the outside-in</td>
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<tr>
<td>Constructivist Theory</td>
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<tr>
<td>Social Interactionist Theory</td>
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<td>Functional Theories</td>
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<td>Theory-of-mind Theory</td>
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</table>

We see that only Executive Function Theory predicts an interrelated causal relationship between LI and PI from the very beginning, although language disorders might be seen as the starting point. When Memory, Attention and Motivation are dysfunctioning, both language and (immediately thereafter) social-cognitive development are affected, negatively influencing each other from that time on. Theories from the inside-out are thought to predict no causal direction between LI and PI, although Modularity and Connectionist Theory allow both disorders to exist independently in one child. Next, 'Theories from the outside-in' all predict a unicausal direction of the relationship between LI and PI. Only Constructivist Theory presupposes that language is part of all other social-cognitive skills, predicting PI → LI. Conversely, all other three developmental theories emphasize
the role of language in interaction with the learning of social-cognitive and ToM skills. These theories would predict LI → PI.

Current theories related to language and social-cognitive development should predict and explain the relatively high co-occurrence of LI and PI within individual children. We showed that relatively few theories make such predictions. Within these theories language disorders are seen as an important predictor for the emergence of internalizing and externalizing psychiatric disorders, especially of those disorders found in children on the autistic spectrum and with ADHD. However, specific language disorders (in different domains) are not yet exclusively related to certain psychiatric disorders. For example, although semantic/pragmatic disorders were found to co-occur frequently with disorders on the autistic spectrum (Bishop and Rosenbloom, 1987), morphological/syntactic disorders were found too (e.g. Van Berckelaer-Onnes, 2002). In order to test the theoretical claims about the causality issue from different theoretical perspectives, only follow-up or longitudinal research designs seem to be suitable (see 1.3.4), provided that language disorders in different domains are described thoroughly in order to disentangle symptoms of LI from PI.

### 2.5 General research questions

It will not be our explicit goal to investigate the causality of comorbidity. Our main purpose here is to describe the possible existence of language disorders in different subdomains of language, namely morphology/syntax and semantic/pragmatics. This will be done with 120 Dutch-speaking children with a psychiatric disorder. We have developed detailed morphological/syntactic models of analysis (see 4.1) and semantic/pragmatic models of analysis (see 10.1) of spontaneous language in two genres. The analyses of morphological/syntactic and semantic/pragmatic skills in both genres will provide a detailed description of the language abilities of these PI-children. We will compare their language abilities with the language abilities of normally developing children (Roelofs, 1998) in order to detect language disorders (see 3.3). We elicited conversational language with a semi-structured interview and narrative language with a picture book (see 3.4). A detailed description of the language disorders in all areas in the PI-population is necessary in order to differentiate LI and PI symptoms better in the future, at the same time contributing to research on the causality issue.

Although language disorders can be seen as an important predictor for the development of PI, as stated above, these predictions have remained too vague and cannot predict specific psychiatric disorders (but see Beitchman et al., 2001). We will try to investigate the extent to which specific language disorders co-occur with specific psychiatric disorders (see 15.6 and 15.7).
The following general research questions are formulated:

**Main research question 1**
To what extent do Dutch-speaking PI-children have language disorders resulting in a comorbid relation of LI and PI in both genres?

**Main research question 1a**
To what extent do Dutch-speaking PI-children have specific language problems in the area of morphology/syntax?

**Main research question 1b**
To what extent do Dutch-speaking PI-children have specific language problems in the area of semantics/pragmatics?

**Main research question 2**
To what extent do Dutch-speaking PI-children have different language problems in the area of morphology/syntax and semantics/pragmatics when we compare both genres?

**Main research question 3**
Is there a relationship between specific language disorders in both genres with specific psychiatric disorders?