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博士学位论文

Functional echolalia and verbal formulae in the speech of Mandarin-speaking children with Autism Spectrum Disorder: Two elicitation studies

Fan Xie

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Supervised by Dr. Esther Pascual

School of International Studies, Zhejiang University

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摘 要

言语仿说（echolalia）意指对他人先前所说话语的部分或全部重复。例如，重复“喝点水”来回答“你要喝点水吗？”。作为孤独谱系障碍（Autism Spectrum Disorders; ASD，又称为自闭症）儿童的典型特征之一，超过四分之三的 ASD 儿童产出言语仿说（Kanner 1946）。然而，言语仿说在自闭症人群的话语中是否具备沟通功能，以及具备何种功能这一议题仍存在争议。本论文旨在探究汉语 ASD 儿童在具有社交与沟通障碍的情况下，如何利用所掌握的有限的语言资源，通过巧用言语仿说来维系会话，即把言语仿说用作认知或沟通策略来帮助其完成交际任务。同时探究 ASD 儿童在此类沟通现象中的表现，及其与语言能力之间可能存在的关系。本论文将归纳总结出适用于汉语学龄前 ASD 儿童的言语仿说类型和功能整合模型，用于帮助 ASD 儿童语言测试与康复治疗，为 ASD 儿童言语治疗师、家长进行有效干预提供科学依据，从而更好地帮助 ASD 儿童克服社交与沟通障碍。同时，本论文将帮助社会上其他群体更好地了解汉语 ASD 儿童的话语特点及其在言语交际中所使用的认知或沟通策略，有助于 ASD 儿童更好地融入社会。

ASD 是儿童早期起病的一种神经发育性障碍，兼有社会交往及交流障碍，兴趣狭窄及重复刻板行为两大核心症状。根据美国精神医学协会《精神疾病统计诊断手册》（DSM-5，2013），学龄前 ASD 儿童语言发育迟缓通常是家长就医的首要原因。临床表现为部分 ASD 儿童言语刻板重复、无意义，使用言语仿说而难以被人理解，或是语言应用困难，难以启动和维持与他人的会话（Lord et al. 2011）。程式语（verbal formulae），作为言语仿说的一种语言表现形式，指的

是连续或不连续，以整存整取的形式呈现的序列话语（Wray 2002: 9）。不同于言语仿说的其他语言表现形式，程式语表达通常为大众所熟知的预制语块，多为同一语言社区的个体所广泛使用，因而辨识度较高。

现有的关于英语 ASD 儿童言语仿说的研究集中探讨了仿说式话语是有意义的回复还是无意义的重复这一论题（Wolff & Chess 1965; Shapiro et al. 1970; Bartak et al. 1975）。言语仿说通常被判定为在社交中以不适当的方式重复，因而部分研究者认为言语仿说是语言表达发育迟缓的病态表现，是应避免和纠正的语言行为（Karmali et al. 2005; Stribling et al. 2007; Valentino et al. 2012）。但其他研究者则认为，言语仿说在 ASD 儿童语言交际中具备维系和延续会话的功能（Fay 1967, 1983; Prizant & Duchan 1981; Prizant & Rydell 1984）。他们认为，言语仿说是 ASD 儿童会话中的一种适应性策略，具备认知与沟通功能（Sullivan 2002; Sterponi et al. 2014），甚至可以帮助 ASD 儿童促进其语言发展（Roberts 2014; Sterponi & Shankey 2014）。例如，ASD 儿童通过使用在关联场景中听到的“*Goal*!（射门！）”来指“足球”，或者引用相应会话框架中他人所说话语来命名某件物体或某个人（Dornelas & Pascual 2016; Pascual et al. 2017）。有关程式语在 ASD 儿童话语中的研究则较少，相关探讨多集中在典型发展儿童的早期语言习得研究中，研究者认为程式语可被用作直接引语，用途十分广泛，在典型发展儿童早期词汇习得中占据了重要位置（Nelson 1973; Lieven et al. 1992）。

国内外的 ASD 儿童语言研究大多集中在语言的形态、语义和句法等方面，而有关 ASD 儿童沟通或语用现象的研究均处于相对空白状态。前人研究集中探讨了 ASD 儿童在不同语言领域的优劣势，包括 ASD 儿童的语法习得能力与语用交际功能之间的分离现象（dissociation）（Tager-Flusberg 1994:198, 2005:188）。

大多数研究支持了 ASD 儿童的语言受损主要存在于语用方面，而非句法语义等结构化语言方面（Naigles & Fein 2017; Naigles & Tek 2017; Naigles 2021; Smith & Tsimpli 2021）。国外研究虽有关于 ASD 儿童言语仿说是否具备功能的探讨，但并未对言语仿说在 ASD 儿童话语使用中表现的复杂特征及类型与功能进行整合归类。且此前研究多为个案研究，因而“言语仿说可用作功能性的沟通策略”这一论述缺乏实证数据的支撑。其次，程式语的相关研究目前仅限于典型发展儿童的语言研究中，尚未应用到 ASD 儿童语言研究领域，这不利于研究者以更全面的视角来探究汉语 ASD 儿童沟通话语的发展特征。最后，以往研究的对象多为英语 ASD 儿童，鲜有研究关注汉语学龄前 ASD 儿童的语言发展。由于 ASD 儿童一般存在着社会交往及交流障碍，而汉语本身又是一门极具特色的语言，语法复杂，且对社会交往及交流中语言的使用有着较高的要求。因此，探究习得汉语的 ASD 儿童的语言发展特征，有利于我们为汉语 ASD 儿童的早期语言干预提供更具针对性的科学指导（Tardif et al. 2008）。

基于前人的研究发现与不足，本论文旨在回答以下两大研究问题：

（1） 汉语 ASD 儿童产出的言语仿说在会话中是一种功能性的沟通策略，还是一种语言发育滞后的病理表现？若被试产出的言语仿说可用作某种功能，那么汉语 ASD 儿童在会话中是如何使用不同类型不同功能的言语仿说来弥补其语言能力发展的不足，从而完成沟通任务的？

（2） 作为言语仿说的一种语言表现形式，程式语的产出频次是否与汉语 ASD 儿童的语言能力（包括早期词汇表达及基本语法掌握能力）之间存在某种关系？若相关，那么较高言语水平组与较低言语水平组 ASD 儿童在程式语的流行率、相关性、复杂性、及创新性方面的表现是否存在显著差异？

针对上述的研究问题，本论文设计了两个实验，分别从质性分析和量化统计的角度来探究汉语 ASD 儿童在沟通中产出的话语特征：实验一旨在探讨言语仿说在诱发任务中的指称及其他沟通功能，从而分析汉语学龄前 ASD 儿童如何在会话交际中使用言语仿说作为认知或沟通策略。实验二继而追踪程式语表达，探究其在汉语 ASD 儿童话语产出中的频次，以及该类表达与 ASD 儿童语言能力之间可能存在的关系。这两个实验互为相关，紧密衔接。

实验一的研究对象为符合美国精神障碍诊断与统计手册第 5 版修订版（DSM-5，2013）诊断标准的 8 名汉语学龄前 ASD 儿童，来自于浙江康复医疗中心儿童早期干预科—杭州青苹果学园。被试均为言语表达较为丰富且能产出较多仿说式话语的 ASD 男童，其平均月龄为 55.50（SD=8.64）。

研究步骤首先采用家长量表报告形式，由患儿家长填写《孤独症行为评定量表》（杨晓玲等 1993）和《汉语沟通发展量表：词汇和句子》（谭霞灵等 2008），分别对 ASD 儿童的自闭症行为，早期词汇表达能力及基本语法掌握情况进行量表调查。两份量表均在评估人员的指导下填写完成，评估人员随即对量表数据进行信度和效度分析。在对上述评估量表进行筛查之后，实验进入诱发任务测试阶段，主试要求被试针对 24 幅经过严格筛选和设计的测试图片（12 幅日常职业或人物；12 幅日常物体）分别回答以下两个问题：这是什么？ / 他是谁？；这个可以用来干什么？ / 他会干什么？测试结束以后，被试家长需要通过设计好的李克特量表就被试对测试材料的熟悉度与辨识度进行报告，以确保所有 ASD 儿童被试熟悉并且能够识别测试材料。

实验一的研究结果显示：（1）汉语 ASD 儿童与其他语言 ASD 儿童一样，产出大量言语仿说，包括延时仿说（delayed echolalia，即引用先前社交场景中他

人所说话语并应用于当前会话沟通中。例如：引用“晚安”来指“床”）和即时仿说（immediate echolalia，例如：立刻重复“什么名字？”来回应“你叫什么名字？”），在本实验中，延时仿说的数量和比例均要高于即时仿说（88%比 12%）。其中，延时仿说是以完成沟通任务为导向而产出的，即时仿说的产出则主要是为了维系会话。（2）在命名任务中，汉语 ASD 儿童产出言语仿说的比例要低于指称名词（25.86%比 49.47%），而在描述任务中，ASD 儿童产出言语仿说的比例则略高于陈述句（25.86%比 17.28%）。（3）汉语 ASD 儿童产出的绝大多数言语仿说均具备功能（61.24%），具体功能包括：命名（例如，仿说“祝你生日快乐！”来命名“蛋糕”），描述（例如，仿说“晚安！”来描述“床”的功能），主题发展（例如，引用“汉堡做好咯！”来更形象地拓展关于“厨师”的话题），会话维系策略（例如，ASD 儿童对其不知道答案的测试图片，通过即时仿说测试问题使得会话继续，当主试开始下一个新话轮时，他们又重新开始回答问题，所以此处对测试问题的仿说并不是无意义的重复），以及认知策略（例如，被问及“警察”的职能时，ASD 儿童首先通过重复测试问题“他会干什么？”帮助其争取思考时间，然后给出问题的正确回答“他会抓坏蛋。”，此处对于测试问题的即时仿说被认为是一种进行自我对话的认知策略）。尽管如此，还是有一些半功能性的（29.59%）和非功能性的（2.04%）言语仿说产出。（4）另外，汉语 ASD 儿童所产出的言语仿说中，有 63%来源于被大众所熟知的程式语表达，包括社会文化场景相关联的程式语（socio-cultural emblems；例如：“生日快乐！”）和社会沟通场景相关联的程式语（socio-communicative formulae；例如：“好久不见！”），另外 35%则来源于仅为 ASD 儿童紧密生活圈所识别的特定场景话语（specific prior enunciations；例如：“大家好，我叫小猪佩奇。”）。

实验一的研究结果支持了虚拟话语引用（即言语仿说）在语言障碍人群话语中的广泛使用（虚拟交际理论 fictive interaction theory; Pascual 2006, 2014; Pascual & Sandler 2016; Pascual et al. 2017）。研究结果揭示了虚拟话语引用似乎可以作为一种适应性策略（adaptation strategy）或迂回策略（roundabout strategy）来弥补 ASD 儿童在会话沟通中语言储备的不足。例如，ASD 儿童通过引用在过去生活场景中听到的问候语“喂，您好？”来命名“手机”。在此类会话中，ASD 儿童构建了一个虚拟的会话场景，并引用了相关联的会话框架中他人所说话语用于当下会话场景中。其所仿说的他人话语并非发生在当下，而是发生在过去，因而此类言语仿说又可称为虚拟话语引用。此外，在构建的虚拟会话框架中，汉语 ASD 儿童在话语沟通中表现出角色转换（perspective-shifting）的能力。例如，当被问及“消防员”的职业时，被试先是把自己代入到火灾中被困者家属的角色并大喊到：“宝宝，那是我的宝宝！”。随即，马上切换到消防员的角色喊到：“喷水，喷水！发射，把火泼灭！”因此，ASD 儿童使用言语仿说在会话中作为一种沟通性或适应性策略，证实了虚拟交际话语在语言障碍人群中的广泛应用。

基于实验一的研究发现，尤其是超过一半的言语仿说来源于为大众所熟知的程式语表达，实验二继而深入探究程式语在 ASD 儿童会话沟通中所表现的话语特征及规律，试图揭示程式语在汉语 ASD 儿童语言发展过程中所扮演的角色。

实验二的研究对象为符合 DSM-5（2013）诊断标准的 63 名 3-6 岁汉语 ASD 儿童，来自于浙江省宁波市一所正规的自闭症培训学校—宁海县以琳康教展能中心。其中有 49 名男孩，14 名女孩，平均月龄为 58.89（SD=8.89）。最初的被试样本包括 90 名学龄前 ASD 儿童，全部资料收集完毕后，逐一对测试过程进行评估，对量表进行审核，最后剔除了 27 名 ASD 儿童。剔除原因包括：ASD 儿

童中途中止测试或口齿不清，ASD 儿童对测试材料辨识度或熟悉度低于平均水平，或 ASD 儿童家长量表填写不完整等原因。被试的选取途径与筛选方法，以及实验步骤同实验一。基于此前提出的第二个研究问题，实验二将被试分为了较高言语水平组（n=41）和较低言语水平组 ASD 儿童（n=22）。进而比较两组 ASD 儿童在程式语产出上表现的差异，及其与语言发展能力之间的关系。

实验二的研究结果为：（1）汉语 ASD 儿童整体的程式语产出水平与其词汇表达能力（r=0.467, p<.001）及各项语法规则使用能力（ps<.001）之间均呈现显著的正相关关系。（2）汉语 ASD 儿童产出了较高比例的程式语表达，较高言语水平组 ASD 儿童产生的程式语在平均数量与比例上明显高于较低言语水平组 ASD 儿童（t=3.966, p<.001）。（3）汉语 ASD 儿童产出的绝大多数程式语均与目标人物或物体，或者相关联的会话场景密切相关，且这一发现同时适用于高低言语水平组 ASD 儿童，但两组之间仍存在着显著差异（t=3.978, p<.001）。

实验二的研究结果发现汉语 ASD 儿童话语中存在大量的程式语表达，支持了基于用法的儿童语言习得理论（usage-based theory）（Bybee & Scheibman 1999; Tomasello 2000；刘正光 2009）。基于用法的语言习得理论认为，大多数儿童所输入的话语都是相对独立的，以具体语言项为基础的（item-based）结构性框架，这类话语儿童每天都会听到很多次。实验二的研究结果表明，患有 ASD 的儿童学习和使用许多相对根深蒂固的语言表达，这类表达被存储和产出为单个固定的语言单位，是在语言使用过程中学会的，而不是基于语法规则生成的。此外，程式语的高频使用可以被视为 ASD 儿童语言发展中的词汇提取和存储策略（lexical retrieval strategy）。在实验任务中，当 ASD 儿童无法从名词词库提取目标名词进行回答时，他们选择从相关联的社交场景中引用常听到的程式语，与当

下沟通话题建立联系，并用于当下会话来完成沟通任务。

实验二进一步证明了词汇概念（例如，“足球”）不仅可以通过视觉信息（即颜色，形状，大小）和具身互动（embodied interactions，例如，踢球）进行存储，而且还可以通过与社会文化或沟通场景相关联的言语体验（verbal experiences，说或听到“*Gooal*！！”）一起存储在长时记忆中。本实验中汉语 ASD 儿童的沟通话语中包含了大量程式语表达，有些程式语的语法复杂度甚至要难于目标名词，表现为将目标名词嵌入在程式语表达中（例如，ASD 儿童使用“擦毛巾”来命名“毛巾”，用“上厕所”来命名“厕所”）。ASD 儿童利用程式语整存整取的心理现实性，似乎在大脑中构建了一个程式语库，与各类常见社会场景相关联的程式语块被整体存储在 ASD 儿童的词库中。然而，不同于其他词库，ASD 儿童可以在具有沟通障碍的情况下快速提取相关程式语，从而帮助他们完成交际任务或维系会话。研究结果支持了 Wray（2002：263）提出的包含了程式语的词库整合模型，体现了 ASD 儿童以不同路径习得词汇的观点。

本论文从语言与认知的角度讨论了言语仿说与程式语在汉语 ASD 儿童会话中所表现出的话语特征及沟通功能性。实验一证实了汉语 ASD 儿童在话语沟通中产出功能性的言语仿说这一事实，且其在会话中表现出的复杂功能在国外言语仿说发现的基础上得到了扩展，即汉语 ASD 儿童在沟通中产出言语仿说用作命名，描述，发展主题，或作为沟通与认知策略，从而达到交际的目的。实验二揭示了程式语在汉语 ASD 儿童话语中的高频产出，并验证了程式语产出与 ASD 儿童词汇表达及语法使用能力之间的显著正相关关系，暗示程式语在汉语 ASD 儿童语言习得与发展过程中的重要作用。

本论文在西方言语仿说研究的基础上，支持了言语仿说在汉语 ASD 儿童会话中呈现沟通功能性的观点，而不能过于关注其在临床诊断上的病理特征，更不能简单地把它归为一种语言的病态表现（pathological default）。从临床实践意义来看，ASD 儿童语言研究是目前中国急需开拓的科研领域（谢帆&苏怡 2016；苏怡&谢帆 2018），中国 ASD 儿童的数量日益增长（Sun et al. 2009, 2013；谢帆 2018），相关科学有效的语言和行为康复治疗体系却尚不完善。本研究设计出了适用于诱发汉语 ASD 儿童言语仿说与程式语的工具，未来可直接应用于汉语学龄前 ASD 儿童会话中沟通策略使用能力的评估。有助于开发更为全面的 ASD 儿童语言测试、诊断和干预工具。此外，汉语 ASD 儿童言语仿说的类型与功能整合模型将为广大 ASD 儿童群体接受更有效的语言康复治疗提供实证数据指导。本论文的研究结果将有助于探究汉语学龄前 ASD 儿童的语言与认知发展，并在一定程度上弥补中国 ASD 儿童语言研究在语用领域的相对空缺状态。本研究呼吁更多的科研人员关注汉语 ASD 儿童语言研究，从而帮助这一特殊群体更好地利用其话语特点来克服社交与沟通障碍。

关键词：言语仿说；程式语表达；沟通策略；汉语自闭症儿童；诱发

Abstract

This dissertation explores the specific functions of echolalia (i.e., the echoing of prior speech) and the production of verbal formulae (i.e., pre-fabricated chunks or fixed linguistic units stored in memory as wholes) in autism speech, mainly consisting of socio-cultural emblems and socio-communicative formulae. In autism research, echolalia has long been considered as meaningless repetition to be avoided (Karmali et al. 2005; Valentino et al. 2012). It may however not be so much pathological as enabling, as it may in fact be used functionally as communicative or cognitive strategy (Roberts 2014; Sterponi & Shankey 2014; Pascual et al. 2017).

The main research question to address is: How do Chinese children with ASD manage to communicate with limited language resources, by using echolalia functionally? This dissertation is designed to include two elicitation studies based on Pascual et al. (2017) and Dornelas (2018), involving images of 12 professions or individuals (e.g., teacher, Peppa Pig) and 12 objects (e.g., birthday cake, towel) commonly associated with given conventionalized meaningful expressions in Mandarin (e.g., 生日快乐！"Happy birthday!"). In both studies, participants were asked to name and describe the target images. The questions posed were: "What's/Who's this?" and "What's it used for? / 'What does s/he do?".

Study 1 compared the production of echolalia vs. corresponding nouns used for naming, and explored the specific functions of echolalia used by Chinese children with ASD (n=8). The results show that ASD children produced a high proportion of functional echolalia, mostly for naming, description, and topic development, a small percentage being used as communicative or cognitive strategy. This reveals the functional complexity of echolalia in autism speech. Study 2 explored the production of widely recognized formulae between high-verbal (n=41) and low-verbal children with ASD (n=22). The results reveal that the majority of verbal formulae (~90%) produced by both groups are ritualized linguistic units associated with the target images. It seems that children with ASD store whole social scenes related to the referents in the lexicon, with formulae forming a salient part of them. Additionally, a strong positive correlation was found between the production of formulae and general language ability (*p*s<.001), indicating that formulae may be a sign of language development in ASD.

Keywords: Echolalia; Verbal formulae; Communicative strategy; Chinese children with Autism Spectrum Disorder; Elicitation

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Chapter 1 Introduction

This dissertation comprises two studies, focusing on the specific functions of echolalia in speech, and the production of verbal formulae and its relation with general language ability of Mandarin-speaking children with Autism Spectrum Disorder (henceforth 'ASD'). The first study helps answer the question on how children with ASD reach their interactional goals or manage the conversation by using echolalia as communicative strategies. The second study aims to examine the relation between the production of verbal formulae and ASD's language ability, thus to explore how the high-verbal children with ASD differ from the low-verbal children with ASD in their formula production.

This chapter first introduces the background information of this dissertation, starting from the topic of language research in autism spectrum disorder (section 1.1). The second section presents the definition of the two communicative phenomena researched (i.e., echolalia and formulae) and their overlaps regarding definition and classification. The following section presents the research questions and objectives (section 1.3). In addition, the theoretical basis is also discussed (section 1.4), and the last section of this chapter states the organization of the dissertation (section 1.5).

1.1 Background of the research

Autism Spectrum Disorder (ASD) is an increasingly common neurodevelopmental condition currently affecting between 1% and 2% of the population in North America,

Europe, and Asia (Chien et al. 2011; Parner et al. 2011; Zablotsky et al. 2015), including mainland China (Sun et al. 2015). Previous studies reported that the prevalence of ASD in mainland China is much lower than that from developed countries (around 1%, e.g., Baron-Cohen et al. 2000). However, a dramatic and gradual rise of autism in the preliminary prevalence in mainland China has been identified by a recent study which recruited 737 children aged 6 to 10 in Beijing, and the estimate of rates is reported to increase to nearly 119 per 10,000 (Sun et al. 2015). This shows that the prevalence rate of ASD in mainland China has already reached the same level as that of western countries (Sun et al. 2015), suggesting the urgency of implementing scientific intervention programs in China.

According to the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V, American Psychiatric Association 2013), which is a widely known manual for mental disorders diagnosis, ASD is characterized by impairments or abnormalities in social interaction, repetitive or restrictive patterns of behaviors, interests, and activities, as well as deficiencies in communication. This manual offers important diagnostic criteria for research in both clinical and academic settings. Language and communication impairments are commonly regarded as one of the earliest signs of ASD in young children later meeting this diagnosis (World Health Organization 1992).

It is widely acknowledged that there is significant heterogeneity in the development of language and communication skills in children with ASD. Generally, ASD is usually categorized as high-functioning or low-functioning depending on the

individuals' IQ scores (i.e., intelligence quotient). In addition, ASD children range from being non-verbal or minimal-verbal, to some developing different levels of syntax and semantics, those who never acquire functional language (Gerenser 2009), and some who are verbally fluent but showing pragmatic deficiencies (Kim et al. 2014). Deficiencies in the acquisition and development of language skills are often regarded as the first concern for parents to seek hospital referrals (De Giacomo & Fengbang 1998). The delay in language acquisition and the deficiency in language development are also critical for predicting cognitive ability in long-term outcomes (Howlin 2005; Mayo et al. 2013).

Even for verbal ASD children, it is reported that most of the speech they produce is not created by themselves, but consists of repetitive utterances echoed from previous verbal experiences. The repetitions of fixed linguistic formulae or prior enunciation, known as echolalia, are observed in more than three quarters of all speaking children with ASD, that is in 75-80% of verbal individuals (Firth 1989). Echolalia is thus regarded as one of the typical characteristics of autism speech (Kanner 1946).[1] In the classical work of Kanner (1943), it is agreed that the core features of atypical language development (i.e., echolalia and pronoun reversals) in childhood autism are so challenging to explore that the research on language development among children with ASD is hard to conduct.

[1] *Pronoun reversal*, i.e., the confusion in the use of 'you' and 'I' in conversation, is regarded as another remarkable feature of language use in children with ASD.

In autism language research, the primary question has typically been: *What are the unique and universal features that define the abnormal language characteristics of autism?* (Kim et al. 2014). This question has gained researchers' attention for more than half a century, since the 1950s. During the 1970s, researchers considered language disorder as the primary diagnostic standard for autism. They even thought that the cause of social deficits in autism was the fact that these children show language impairments (e.g., Rutter 1970). Until the mid-1970s, developmental psycholinguists conducted carefully designed experimental studies to compare language performance in children with ASD and children with other language disorders (e.g., mental retardation) as well as typically developing children, so as to specify the unique features of the use of language in autism speech (e.g., Bartak et al. 1975, 1977; Bartoclucci et al. 1976; Pierce & Bartoclucci 1977; Tager-Flusberg 1981a, 1985, 1990).

After exploring the formal aspects of language (i.e., phonology, morphology, semantics, or syntax) in ASD, researchers gradually shifted their attention to the command of pragmatics by children with ASD. During the 1980s and 1990s, researchers were primarily concerned about the difficulties in using pragmatics. This change revealed a shift of focus from the children's pure language disorder to their social-communicative impairments, later regarded as the core deficit in ASD (e.g., Cantwell et al. 1989; Gernsbacher et al. 2005). However, the concern of pragmatic competence in autism speech did not last long. Until the last decade, researchers' interests were back to the investigations of linguistic competence in ASD. Again, they attempted to compare the language impairments between children with ASD and

children with other language disorders (e.g., specific language impairment, Kjelgaard & Tager-Flusberg 2001; Tomblin 2011; McGregor et al. 2012).

Thus, as a communicative phenomenon, echolalia is regarded as a typical characteristic of autism speech, but has nonetheless received little attention. Most prior studies explored the phonology, morphology, semantics, or syntax of autism speech. These studies mainly focused on investigating whether children with ASD share some similarities with their matched controls, or whether they differ from children with other developmental or language disorders on the formal aspects of language. The general conclusion was surprising: children with ASD do not show differences in language acquisition on the phonological, morphological, or syntactic domains (Tager-Flusberg 1981b). Most researchers are interested in investigating the atypical language developments in autism speech to help with diagnosis. Still, more research is needed to explore the specific characteristics and developmental patterns of ASD language, so as to introduce a more comprehensive picture of autism speech, which eventually helps with assessment and treatment.

1.2 The working definition of *echolalia* and *verbal formulae*

This section first introduces how this research defines the two closely related language phenomena: echolalia and formulae, as the topics of the two studies in this dissertation. Then, the overlaps between echolalic utterances and formulaic occurrences in definition and classification are explained.

1.2.1 Introducing *echolalia*

Echolalia, as defined, is the verbatim or semi-verbatim repetition of part or all of a previously spoken utterance (i.e., words, phrases, or sentences), and is regarded as a typical characteristic of autism speech since Kanner's early description of the syndrome (Kanner 1943, 1946; Prizant & Rydell 1984). Echolalia is classified as a typical example of stereotyped or repetitive speech in ASD; around 75% of verbal children with ASD produce echolalia (Kanner 1946). It is embedded in the second diagnostic criteria "*restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history*" in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V; American Psychiatric Association 2013: 50). This officially published diagnostic manual for clinicians misleads researchers to understand echolalia as a pathological default. As it is, clinically, echolalia is endowed with a diagnostic attribute, which generally leads to studies regarding it as an indication of a language pathology, comparing with the speech of typically developing children who produce less echolalia.

Particularly, echolalia is commonly defined as the socially awkward or inappropriate verbatim repetition of the speech of others (Karmali et al. 2005; Stribling et al. 2007; Valentino et al. 2012). Some other researchers agree that echolalia might be an adaptive strategy that could have communicative functions for children with ASD (e.g., Sullivan 2002; Roberts 2014; Sterponi et al. 2014; Sterponi & Shankey 2014). At least on the interactional level, echolalia may serve to refer to or describe individuals or entities, and functions to maintain the conversation, or save time for self-thinking.

Following Dornelas & Pascual (2016), and Pascual et al. (2017), this research includes three types of echolalia: 1) fixed and entrenched socio-cultural emblems that are closely associated with given social scenes (e.g., saying 生日快乐！"Happy birthday!" for 'cake'; saying 射门！"Goal!" for 'soccer'); 2) socio-communicative formulae that are related to specific interactional contexts (e.g., using 喝点水, "Have some water" for 'glass'; using 上厕所, "Go to the toilet" for 'toilet'); and 3) specific prior enunciations that are echoed from given prior scenarios or situations in the child's life (e.g., uttering 我是小猪佩奇, "I am Peppa pig" for 'Peppa pig'). These three types of echolalia constitute instances of delayed echolalia, namely repetitions that happened some minutes, days, or even months after the original source enunciation or expression being repeated. By contrast, immediate echolalia constitutes repetition echoed immediately after what is being repeated, so in the following conversation turn. An example is saying "*you want some water*" as a positive answer to the question "Do you want some water?".

1.2.2 Introducing *verbal formulae*

According to the available literature, a *verbal formula* is a language phenomenon that may encompass various types of word strings and appears to be stored and used as an integral whole. Wray (2002:9) defined a formula as: "*a sequence, continuous or discontinuous, of words or other meaning elements, which is, or appears to be, prefabricated: that is, stored and retrieved whole from memory at the time of use, rather than being subject to generation or analysis by the language grammar*." Wray

(2002) systematically explored this language phenomenon (i.e., formulaic sequence) and collected formulaic data in adult language, first language acquisition, second language acquisition, and language disorders. Later, Wray's book (2008), as one of the most comprehensive guides, also opened a door for later research on formulaic language. On the role of formulae, prior studies on first language acquisition and adult language supported the idea that formulaic language is functional in language acquisition, playing the roles of an acquisitional aid, a short-cut in processing, a tool for social interaction, and a feature of development (e.g., Nelson 1973; Plunkett 1991; Lieven et al. 1992; Hickey 1993; Wray & Perkins 2000).

In this research, verbal formulae mainly constitute widely recognized expressions that are fixed and entrenched, and can be identified by the wide language community. For example, the frozen expressions 打电话，"Make a call" and 生日快乐，"Happy birthday" are typical occurrences of socio-communicative formulae and socio-cultural emblems, respectively, produced as a communicative strategy by both typically developing children at a formulaic stage or used by children with ASD at an older age. However, the use of verbal formulae as adaptation strategy is wider in autism speech and is also endowed with more communicative functions in conversation.

1.2.3 Relations between echolalia and formulae

The two phenomena studied in this dissertation share some similarities, particularly in the use of echolalic utterances and formulaic occurrences in ASD speech. For example, some widely recognized formulaic expressions (i.e., socio-cultural emblems or socio-

communicative formulae) could be echoed from the speech of others, in which case the formula can be classified as echolalia. However, in some other cases, they differ from each other. When the echoed utterances can only be identified by the children's close circle (i.e., specific prior enunciations), then such echolalic expressions are not formulaic for the wide community, and thus they cannot be classified as formulae. For example, some utterances echoed from others' speech are not formulaic in form but indeed echolalic in use. An example is the specific prior enunciation; 小猪佩奇跳泥坑, "Peppa pig jumps into the mud pits", echoed from a line in the famous cartoon movie *Peppa Pig* that the child heard many times. In the meantime, if the formulae are not echoed from the prior speech of others at a particular past point in time, but produced in the conversation in the here-and-now, then they are not echolalic.

So, when identifying an utterance as echolalia or formula, the source of the original formulaic sequences matters. Thus, echolalia and formulae are systematically related but differ from each other. Their relations are displayed in the following pie chart in **Figure 1.1**.

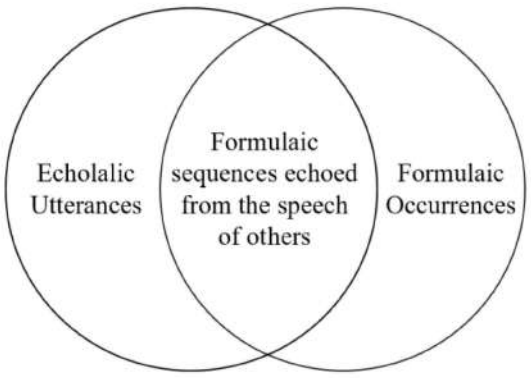

Figure 1.1 Relation between echolalia and formulae

As shown in **Figure 1.1**, the overlapped part of echolalic utterances and formulaic occurrences are formulaic sequences echoed from the speech of others, which includes the fixed expressions that are widely identifiable by the linguistic community, mainly involving socio-cultural emblems (e.g., "Happy birthday") and socio-communicative formulae (e.g., "Drink some water"). As for the expressions echoed from previous verbal experiences that could only be recognized by the children's close circle (i.e., specific prior enunciations), they belong to the part that is not intersected with the circle of formulaic language. As for the part in formulaic language un-overlapped with the circle of echolalic utterances, it contains the expressions that are entrenched and fixed in form, but are not echoed from others' prior speech.

In conclusion, echolalia is classified as the repetitions of particular prior speech heard from others, which includes both the widely recognized formulae (i.e., socio-communicative emblems, socio-cultural formulae), and non-formulaic specific prior enunciations.

1.3 Research questions and objectives

This dissertation addresses two research questions: 1) Do Chinese children with ASD produce echolalic utterances as functional strategies or pathological default? If echolalia is used functionally by ASD children, then how do they manage a conversation, given their limited resources, by using this strategy? And 2) How does the language ability (i.e., the expressive vocabulary size and the command of grammatical categories) of children with ASD impact their production of formulaic

occurrences? If there is a correlation, then how do high-verbal ASD children differ from their low-verbal counterparts in their use of formulae?

This dissertation presents two studies to answer the above research questions, one on the functional usages of echolalia by 8 Chinese children with ASD, and the other on the production of formulae between 41 high-verbal and 21 low-verbal ASD children. This dissertation analyzes both qualitative and quantitative language production data in order to understand more comprehensive developmental patterns in the two communicative phenomena of echolalia and formulae. This will hopefully shed light on how to develop more scientifically informed intervention tools for rehabilitating their pragmatic deficiencies in communication.

The first study explores the specific functional usages of echolalia, which is designed to address the debate on the functionality of echolalia in ASD communication, and finally builds two integrated models of the types and functions of echolalia that can be eventually used for assessment and treatment. Specifically, this echolalia study examines: 1) the proportion of echolalic occurrences produced (e.g., using "Drink some water" to name a glass) vis-à-vis referential (e.g., 'glass') and descriptive alternatives (e.g., This is a glass); 2) the specific functions of echolalic utterances used in different social or communicative situations; 3) the frequency of different types of echolalia varying in time span, relevance, complexity, and creativity. The in-depth qualitative analysis, combined with the quantitative data, is meant to investigate the functional complexity of echolalia in autism conversation. This study thus explores how children with ASD use communication skills to interact with other speakers, and the strategies

they use to maintain the conversation by using echolalia functionally.

The second study examines the relation between the production of formulaic occurrences by ASD children and their language ability, and then compares the performance of verbal formulae between the high-verbal and low-verbal ASD children. Specifically, this formula study aims to explore: 1) the frequency of the production of formulaic sequences and the relevance of formulae vis-à-vis to the ongoing interactions; 2) the relations between formula production and participants' general language ability (i.e., expressive vocabulary and the command of grammatical categories); 3) the differences in the formulaic occurrences between the high-verbal and low-verbal children with ASD. This study thus exemplifies the role of formulae in language development of Chinese children with ASD.

1.4 Theoretical framework

This dissertation broadly explores the function of echolalia and the role of formulae in autism communication, which is based on fictive interaction theory, the usage-based theory of child language acquisition, and the integrated lexicon model involving formulaic language. This section discusses the three theoretical foundations of the dissertation.

1.4.1 Fictive interaction theory

Language is mostly used in intersubjective interaction between addressers and addressees, which is the most common way for people to know about others' ideas,

feelings, thoughts, emotions, attitudes, intentions, etc. A conversation is typically a face-to-face interaction between speakers and hearers, in order to exchange messages, such as ideas, feelings, thoughts, and opinions. The conversation frame usually includes the roles of: addresser, message, addressee, and overhearer (Goffman 1963).

Fictive interaction (Pascual 2002, 2006a, 2014) is defined as a communicative type of fictivity, in the sense of Talmy ([1996] 2000), since it is conceptual in essence and it is different from genuine communicative occurrences, or completely fictitious dialogues, such as in movies or novels. Fictive interaction is a cognitive, discursive and linguistic phenomenon, which helps frame cognition, discourse, and grammar (Pascual 2002, 2006b, 2014; Pascual & Sandler 2016; Pascual & Oakley 2017).

Pascual (2002, 2006b, 2014) claims that fictive interaction helps to structure: 1) cognition, referring to thought as inner conversation (Vygotsky [1934] 1962; Clark 1992, 1996; Zlatev 2007, 2008; Zlatev et al. 2008; Sinha 2009) For example, saying "*you have to be brave*" to encourage oneself; 2) the conceptualization of reality as conversational (cf. Cooren 2010, 2012). For example, conceptualizing inanimate entities with animate characteristics, "A good talk is the *answer* to quarrel"); 3) discourse organization, such as dialogic monologues, using the second-person pronoun to show the involvement of a conversation with the reader (e.g., Linell 1998; Herman 1999). For example, using "*you know*", "*you see*", and "*let me tell you*" in monologic writing, as a communicative exchange between addresser and addressee, to make the text flow better; 4) language structure and use (i.e., rhetorical questions; Bakhtin 1975; Pascual 2002, 2006, 2014; Xiang et al. forth). An example is writing "*blooming once*

a year is not enough for me" ascribed to a type of flower as a fictive addresser, as the persuasive rhetoric of fictive interaction in marketing (Brandt & Pascual 2016).

In language, fictive interaction becomes manifest at different levels, including the inter-sentential level (e.g., "*Why do I say this*? Because we shouldn't bother"), the sentential level ("*Why bother*?"), and the intra-sentential level ("the *Why bother*? attitude"), these examples are quoted from Pascual (2014: 20). Fictive enunciations occur in various discourses or contexts, such as in children's traditions and literature (e.g., inanimate characters may appear as fictive addressers or addresses). For example, a boy may say to a car, "*Come on! run fast! If you lose the game, I'll hit you with a stick!*" (Pascual 2014), in which the car is a fictive addressee, being regarded as an animate character who will receive 'physical' punishment for losing a car-racing game. Fictive interaction also occurs in religious texts (e.g., Pascual & Sandler 2016), in marketing (Brandt & Pascual 2016; Pascual & Sandler 2016), and in judicial argumentation (cf. Coulson & Pascual 2006; Pascual 2002, 2006a, 2008a, 2014).

Fictive uses of verbatim speech (i.e., what has also been called echolalia) have also been studied in children with ASD (e.g., Dornelas & Pascual 2016; Pascual et al. 2017; Dornelas 2018). In the speech of ASD children, as compared with typically developing children, Pascual and colleagues explored how fictive enunciation (Pascual 2002, 2006, 2014) is manifested as verbatim repetition of prior speech in the naturalistic and elicited speech of Brazilian children with ASD, compared with typically developing controls. The ASD group was reported to echo speech previously heard from others (i.e., delayed echolalia) in order to make mental contact with the

previously-encountered communicative contexts or prior interactional experiences. Fictive interaction manifested as echolalia, or the fictive uses of verbatim speech in language pathology, is reported as an effective compensatory or adaptation strategy for children with ASD in conversation.

1.4.2 The usage-based theory of child language acquisition

This research is also conducted under the framework of the usage-based perspective of child language acquisition. The usage-based theory of language focuses on specific usage events (particular communicative situations), particularly in which children acquire language (Langacker 1988, 2000; Tomasello 1992, 2000, 2002, 2003; Tomasello & Brooks 1999). For example, in usage-based language models, researchers believe that language emerges from the actual usage events in which people communicate through language, and in the processes of language acquisition during childhood (Bybee 1985, 1995; Bybee et al. 1994; Croft 2000). This approach regards language as a structured 'inventory' of symbolic units that comes from experiences across communicative situations in daily life. Such linguistic experience contains processes of entrenchment, because of repeated uses of particular expressions across accumulated linguistic experiences.

From the perspective of usage-based theory, people use many relatively fixed, entrenched, item-based linguistic expressions. For example, the Chinese use the fixed expression 你吃了吗？"Have you eaten?" as a salutation, which is similar to "How

are you?" in English-speaking countries. In this example, the formulaic entrenchment is semantically obscure, as it cannot be understood literally.

Such ritualized utterances are formulaic in form, appear to be prefabricated, and are retrieved as whole from long-term memory (e.g., Bybee & Scheibman 1999). The frequent production of echolalic verbatim in autism speech could be explained by using the model of usage-based theory; most ASD children produce formulae echoed from their prior interactional experiences in conversation. Many children with ASD learn the entrenchments from different interactional experiences and then use the entrenched phrases functionally in appropriate contexts or situations. It is possible that they have not acquired the single words in the fixed expressions analytically (please refer to the discussion on holistic vs. analytic ways of acquisition in Chapter 5). Still, they can use the utterance appropriately as a whole to express complete and coherent communicative intentions. Thus, ASD children acquire and use entrenched phrases to communicate, and they learn fixed expressions by frequently using or hearing them in conversations. This deepens the understanding of child language acquisition, and helps to answer how children build up the most fundamental aspects of their linguistic competence during childhood. This theory also helps shed new light on atypical child language acquisition.

1.4.3 Formulae in the lexicon

Concerning the model of lexicon involving formulaic language, it is reported that children rely heavily on formulaic language to get themselves started in the early stages

of language acquisition. Similar to second language learners, acquirers of a first language seem to find formulaic (prefabricated) language a more accessible option in their language processing and production. Thus, formulaic language is an important component of the lexicon in both first and second language acquisition.

The relation between verbal formulae and the lexicon culminates in a new model of lexical storage, which accommodates speech in language disorders, such as aphasia and autism (Wray 2002). According to the integrated model of the lexicon (Wray 2002: 263), two lexicons called *interactional (routine) lexicon* and *memorized lexicon* are mainly composed of formulaic word strings (strings of words stored and processed holistically). In the other three lexicons (i.e., *grammatical lexicon*, *referential lexicon*, and *reflexive lexicon*), there are also some formulaic expressions as component parts, but they mainly consist of other morphemes or polymorphemic words, instead of the formulaic linguistic units (see the discussion of Chapter 5).

In conclusion, the theoretical framework of this dissertation is based on Pascual's theory of fictive interaction (2002, 2006a, 2014; Pascual & Sandler 2016), as manifested in autism speech (Dornelas & Pascual 2016; Pascual et al. 2017; Dornelas 2018), the perspective of usage-based theory of atypical child language acquisition (Tomasello 2000, 2002), and the role of formulaic language in the lexicon of autism speech (Wray 1999, 2002, 2008; Wray & Perkins 2000).

1.5 Organization of the dissertation

This dissertation is composed of six chapters. In the present chapter, I first introduce the background of this research, the working definition of the topics of the two studies in this dissertation (i.e., echolalia and verbal formulae). In addition, I also present the research questions and objectives. Then, the theoretical foundations of this dissertation are illustrated.

Chapter 2 reviews previous studies on echolalia and formulaic language in separate sections. The review of previous studies on echolalia concludes the studies on the debate on the functionality of echolalia in autism speech (i.e., echolalia as a pathological default vs. echolalia as a functional strategy in conversation), and studies on different types of echolalia (i.e., immediate vs. delayed echolalia; pure vs. mitigated echolalia). Given the fact that limited studies so far have explored formulaic language in children with ASD, the review of prior research on formulaic language sums up the studies on formulaic sequences in adult language, child language, and language disorders (i.e., aphasia and autism). Furthermore, the section of the research gap summarizes the innovative aspects of this research, from the perspectives of language domain, research methods, and target participants.

Chapter 3 presents the pilot study, in which the criteria on the selection of the stimuli materials and the design of stimuli images are demonstrated. A pilot Likert five-point scale of Chinese preschoolers' familiarity with 50 concepts and the related formulaic expressions was designed, primarily including the screening average familiarity scores and the frequency of producing formulae vs. common nouns for each

stimulus concept (see **Appendix 1**). This chapter first introduces the design of the pilot study, and then presents the information of participants, materials, protocol, and the procedure of the pilot study. The main section discusses the results, including the participants' familiarity scores of initially selected concepts, and the percentages of producing formulaic expressions vs. common nouns of each selected concept. The results of the pilot study help with the design of the elicitation experiments in the following two studies of this dissertation.

Chapter 4 lays out the first study on functional echolalia used by 8 children with ASD, dealing with socio-cultural and socio-communicative formulae, and repeated prior utterances used as a communicative or cognitive strategy. This chapter first analyzes the data on the functions of echolalia qualitatively, including both delayed and immediate functional echolalia, and their related functions as question-oriented, conversation or self-oriented echolalia. Five specific functions are summarized: naming, description, topic development, conversation management strategy, and cognitive strategy. After the qualitative analysis of the language data, the quantitative results of the types and functions of echolalia are also illustrated. This includes the comparisons between the production of echolalia vs. referential nouns vs. descriptive statements, and the distributions of proportions between functional vs. non-functional echolalia. In the discussion section, the verbatim fictive speech manifested as echolalia is conferred based on fictive interaction theory. The social-emotional salience approach is used to explain the strategy of shifting perspectives by using echolalia functionally.

Finally, how the common nouns are embedded in the echolalic utterances is also discussed.

Chapter 5 presents the second study on the production of formulaic occurrences by 63 children with ASD, which explores the role of formulae in autism speech, by comparing the performance of formulae between the high-verbal (n=41) vs. low-verbal (n=22) ASD children. This study first examines the relation between formula production and the ASD children's general language ability, including expressive vocabulary size, the acquisition of different lexical categories, and the command of grammatical categories. Then this study compares the average amount and percentages of the production of formulaic occurrences and their related relevance (i.e., relevant vs. non-relevant), the complexity (i.e., isolated vs. embedded), and the creativity (i.e., exact vs. modified) of formulae produced by the two ASD groups varying in verbal abilities. The positive correlation between formula production and general language ability reveals the role of acquisition strategy of formulae in atypical child language acquisition.

The last chapter is the concluding part. I first summarize the significant research findings of the two studies. Then I conclude with the implications, including the theoretical and clinical contributions. In addition, the social values are laid out, particularly the possible practical applications of the designed protocol in assessing the pragmatic performance of children with ASD in conversation. Last, the limitations and suggestions for future research are mentioned at the end (e.g., comprehensive studies and longitudinal language research in children with ASD are needed).

Chapter 2 Literature review

This chapter offers a review of the existing body of research on echolalia and verbal formulae and is organized in five sections, including: 1) the introduction to the main contents of the chapter; 2) the review of studies on echolalia (i.e., the repetition of the speech of others) in autism speech; 3) the overview of formula studies in language acquisition; 4) the research gap of previous studies and the innovations of this research based on the current developments in the field; and 5) the summary of the existing research on echolalia and formulae.

2.1 Introduction

Except for the introduction and summary sections, the other three main sections provide an overview of studies on echolalia and formulae respectively, as well as the research gap.

The first main section discusses previous studies on echolalia in children with ASD, involving the debate on whether echolalia is a meaningless pathological default or a cognitive or communicative strategy. Also, the studies on different types of echolalia in autism speech are summarized (i.e., delayed vs. immediate echolalia; pure vs. mitigated echolalia). Thus, the focus was on the debate and the types of echolalia, but the functional aspect of echolalia in autism speech should receive new insights in linguistics. Additionally, unlike the considerable interest in formulae in first language acquisition and second language learning, attention paid to formulae in communicative

language disorders has been limited. The second main section reviews prior studies on the identification and the use of formulaic sequences in adult language, child language, and language disorders (i.e., aphasia, autism). The third main section shows the current situation of autism language research, concluding what have been found in previous studies on echolalia and formulae, explaining why there are limited studies on such communicative phenomena, and finally discussing what are the research gap for this dissertation to fill in. The final section presents a brief summary of the above sections.

The review on this topic is introduced systematically in this chapter to better present the studies on the function of echolalia and the role of formulae in Mandarin-speaking children with ASD in the following chapters.

2.2 Review of previous studies on echolalia

Echolalia, the echo-like repetition of the prior speech heard previously, is defined as the literal quotation of formulae encountered in prior interactional experiences (Kanner 1946; Prizant 1983; Prizant & Rydell 1984; Neely et al. 2016), including socio-communicative or socio-cultural formulae and specific prior enunciation (Dornelas & Pascual 2016, Pascual et al. 2017).

Most prior echolalia studies mainly focused on atypical features of echolalia, its diagnostic attribute, and the debate on the functionality of echolalia in English-speaking children with ASD (e.g., Fay, 1967, 1983; Prizant 1981, 1984; Paccia & Curcio 1982; Local & Wootton, 1995; Tarplee & Barrow 1999). In addition, most previous research focuses on immediate echolalia; few exploring delayed echolalia

(Wootton 1999, see Chapter 1 for the definition and classifications of immediate vs. delayed echolalia). Regarding methodology, most previous research constituted case studies, investigating spontaneous speech in naturalistic settings, rather than elicitation tasks or controlled experiments. Concerning the research objectives, most prior studies aimed to find how to avoid echolalia production in ASD, instead of how echolalia predicts development from a single word to multi-word stage, or how echolalia helps children with ASD manage the conversation with limited language resources they have.

Then, the studies on different types of echolalia in children with ASD are presented, which helps to set the scene on the discussion of the first study on functional echolalia and how I analyze different types of echolalia (as presented in Chapter 4). In the final subsection, I summarize prior studies on echolalia in children with ASD and point to the research gap of previous research on echolalia.

2.2.1 The debate on the functionality of echolalia in autism speech

After Kanner (1943), echolalia in autism speech has been widely documented and researched. Early studies focused on exploring whether echolalia is meaningful repetition or purposely used as an adaptive communicative strategy and the relations between the echolalic and different developmental stages. Kanner (1943) reported that children with ASD gradually abandon echolalia between the ages of 5 and 6. Rutter and Lockyer (1967) also suggested that children with ASD go through a period of marked echolalia, which seems to be a transitional phase that they move through as they develop other functional language skills. Prizant (1987) demonstrated that

echolalia might not be a transitional phase for less able verbal ASD children, since they continue to have difficulty with linguistic rules but are more likely to use echolalia as communicative strategy throughout their lives. Fay (1967) indicated that the production of mitigated echolalia (i.e., echolalic utterances with slight modifications from the source) reflects a developmental progress in spontaneous speech.

However, most researchers agree that echolalia is a pathological default in the early stages, indicating language disorder or language delay for children with ASD. This leads to a negative research trend that most studies focus on the negative effects of echolalia in children with ASD.

Importantly, there is still a debate concerning the overall function of echolalia in ASD speech (Sterponi & Shankey 2014). The first strand of research indicates that the frequency of echolalia production by children with ASD is much higher than that of children with other language disorders or typically developing children. Research suggests that the verbal repetition in autism speech is abnormal, regarded as a sign of failure to communicate (e.g., Wolff & Chess 1965; Shapiro et al. 1970; Bartak et al. 1975). By contrast, another strand of research discerns the cognitive strategy and functions in communicative interaction that echolalia serves for children with ASD (e.g., Prizant & Duchan 1981; Prizant & Rydell 1984; Dornelas & Pascual 2016; Pascual et al. 2017).

The following subsections present studies from opposite sides of the debate on the functionality of echolalia in children with ASD. The first subsection introduces the studies regarding echolalia as a negative indicator for language development in autism

speech. The second subsection displays the contrary view and supports the function of echolalia as communicative or adaptive strategy for children with ASD.

(a) Echolalia as non-functional: A pathological default

Echolalia has traditionally been defined as the socially awkward or inappropriate repetition of a prior utterance (or part of one) with no communicative function (Karmali et al. 2005; Valentino et al. 2012). Some early autism studies dismiss echolalia as a sign of cognitive impairment, a pathological default to be discouraged, consisting of meaningless, obsessive repetitions (e.g., Valentino et al. 2012).

Echolalia, as a predominant characteristic in children with ASD, has been regarded as an interference with the development of functional language (Valentino et al. 2012). Early research concerns echolalia as an antithesis to appropriate responses and development of language, and researchers focus on exploring how to decrease echolalia in autism speech (McMorrow & Foxx 1986; McMorrow et al. 1987; Foxx et al. 1988; Foxx & Faw 1990). For example, some researchers think that echolalia reflects a comprehension deficit because echolalic children with ASD are reported to have a poor comprehensive ability (Butter 1968; Fay & Butler 1968). In addition, some research even supports that ASD individuals should replace echolalia by general responses, such as "I don't know" to continue the conversation in tests, instead of using echolalia (Schreibman & Carr 1978). Echo-like repetition of previously heard utterances is even regarded as the most striking abnormalities to early language development in autism speech (Wolff & Chess 1965).

Most of these studies investigate immediate repetitions of previously heard utterances. This is understandable, since immediate echolalia is much easier to identify than delayed echolalia. However, the functions of echolalia should not only be generalized by one type of echolalia; delayed echolalia should also be taken into consideration. Particularly, delayed echolalia has more abundant forms and understanding it better could help therapists and caretakers in their ordinary interactions with ASD children.

(b) Echolalia as functional: A redefinition of echolalia

Long considered meaningless repetition and behavior to be avoided, echolalia may be used functionally in ASD and may even help language development (Roberts, 2014; Sterponi & Shankey 2014). Recent research shows that echolalia may in fact be an effective adaptive communicative strategy (Prizant 1983; Dobinson et al. 2003; Stribling et al. 2007; Roberts 2014; Pascual et al. 2017), some calling for a redefinition of echolalia as an interactional resource in autism communication (Sterponi & Shankey 2014). Examples are saying "*Goal!*" for 'soccer', quoting somebody's words to refer to them, or answering a question like "Do you want some water?" positively with "*You want some water*".

Research suggests that children with ASD use repetitions much more frequently and widely, and for a longer period, than younger typically developing children (e.g., Dobinson et al. 2003; Dornelas 2018). Moreover, while children with ASD use delayed echolalia as an adaptive communicative strategy, controls of the same chronological

age use similar types of repetitions of previously heard speech as a rhetorical tactic, to attain effects such as humor or engagement (Pascual et al. 2017). The pathological aspect of echolalia is due to the degree to which it persists as a dominant strategy in ASD speech compared to that of neurotypical toddlers. However, echolalia still seems to be a transitional phase that they move through as they develop other functional language skills (Kanner 1943; Prizant 1987).

The frequency of echolalic speech in autism may predict interactional functions in communication (Dobinson et al. 2003) and even higher verbal functioning with age (Lovaas et al. 1973). For example, children with ASD who are echolalic before starting language programs have a more positive prognosis for functional language development. Other studies identified that marked mitigated echolalia seems to suggest an increment in language comprehension and production (Shapiro et al. 1970; Fay & Coleman 1977). Furthermore, the use of echolalia seems to reflect developmental progress in spontaneous speech and comprehension (e.g., Fay 1967; Fay & Coleman 1977). For example, some ASD children repeat language as a compensatory strategy to process spoken language, some repeat language due to a difficulty in understanding, and some use verbatim repetition to maintain the flow of conversation (e.g., Phillips & Dyer 1977; Shapiro 1977; Prizant & Duchan 1981).

Moreover, a strong echoic repertoire is reported to lead to self-prompting, which is an essential skill for the development of more complex verbal behavior (Sautter et al. 2011). The trend is clearly towards considering echolalia a developmental

phenomenon in the child's normal cognitive and linguistic maturity (see overviews in Schuler & Prizant 1985; Sterponi & Shankey 2014).

Thus, in the review of echolalia in autism speech, I found that the debate is still unresolved, affecting clinician's diagnosis, assessment, and treatment. More research on functional echolalia is needed to help build a more comprehensive picture of the functions of echolalia in children with ASD.

2.2.2 Different types of echolalia in autism speech

There are numerous investigations of the main types and functions of echolalia (Fay 1967; Prizant & Rydell 1984; Schuler & Prizant 1985). The repetition in question may occur right after what is echoed or after some delay (i.e., immediate vs. delayed echolalia, Prizant & Duchan 1981; Wootton 1999), and the original utterance may be repeated entirely or partially (i.e., pure vs. mitigated echolalia, Fay & Butler 1968). Mitigated echolalia includes occurrences in which the echoed bit appears modified (if ever so slightly) and those that are verbatim but integrated into a larger grammatical structure (see a systematic review in Neely et al. 2016).

Regarding its types, functional, interactive *immediate* echolalia may involve: turn-taking, declarative utterances, yes/no answers, and requests (Prizant & Duchan 1981; Sterponi et al. 2014; Sterponi & de Kirby 2016). Functional interactive *delayed* echolalia may include turn-taking, information-providing, labeling, calling, protesting, requesting, completing, affirming, directing, and maintaining social interaction (Prizant

1983; Prizant & Rydell 1984; Pascual et al. 2017, for an overview see Schuler & Prizant 1985 and Volkmar et al. 2005).

This section reviews detailed classifications of different types of echolalia in prior research, together with related examples, helping to understand the clear distinctions between different types of echolalia. The related functions are mentioned briefly in the introduction on the types (immediate vs. delayed and pure vs. mitigated echolalia).

(a) Immediate vs. delayed echolalia in children with ASD

Immediate echolalia refers to the repetition of the immediately preceding utterance in the previous conversation turn, and has been widely researched in previous studies on autism speech (e.g., Prizant 1981; Paccia 1982). It has been defined as the "*meaningless repetition of a word or word strings just spoken by another person*" (Fay 1969: 39). This idea is supported by the group of behaviorally oriented researchers, who consider echolalia a communication disorder in itself (e.g., Lovaas 1977).

Santan (2013) put forward some criteria to quantify whether an occurrence of echolalia is immediate, in order to explore repetitive speech in autism. The classification criteria constitute: whether the length of the chain is more than one; whether the talker in the head of the chain is the child when the previous talker is the interlocutor (Santan 2013: 374). One example is when the child utters "*Happy birthday to him!*" following the experimenter saying "Say happy birthday to him!". Here the child repeats the sentence right after the previous utterance, omitting only one connection word, i.e., 'say'. In the elicitation data of this research, there were also

numerous examples of immediate echolalia, even though the task was designed to elicit delayed echolalia. For example, when the experimenter (i.e., the author of this dissertation) asked, "What's this?", the child repeated "*What's this?*" immediately in the conversation turn.

On the function of immediate echolalia, Kanner (1946) was the first researcher who ascribed a specific function in the use of immediate echolalia, classified as *affirmation by repetition*, that is, giving one's confirmation by echoing the interlocutor's utterance immediately after it is produced. For example, when the child's teacher asks, "Do you want some water?", the child immediately repeats the sentence "*You want some water*" to express that he wants some water. In contrast to behaviorally oriented researchers, linguists have discovered how immediate echolalia functions in the speech of children with ASD. It performs to maintain the social interactions when children have severe comprehension problems (Fay 1969; Philips & Dyer 1977; Shapiro 1977). However, the functionality of immediate echolalia has not been fully explored, even though a significant number of studies focused on immediate echolalia in autism speech. Most of the prior studies examined how the immediate echolalic utterances are structured, with or without modifications, but ignored the functions of immediate echolalia in communicative contexts.

The other type of echolalia regarding the time span, so-called *delayed* echolalia, refers to the repetition of verbal utterances that were previously heard and repeated at a significantly later time (Prizant & Rydell 1984), after a few minutes, hours, days, weeks, months, or even years (Vicker 1999). Most of the echolalic utterances produced

by children with ASD in this research were delayed echolalia. For example, when the experimenter asked "What's this?" relating to the glass, the child answered "*Have some water*" for the naming question. After consulting the parent, it was confirmed that this is an echoed chunk heard from maternal speech when asking the child to drink some water in the child's daily life.

Very few studies focus on functional delayed echolalia in autism speech. The most classical study on the functionality of delayed echolalia was briefly presented in the beginning paragraph of this subsection. An example of the function *completing* is the following: when the experimenter says, "Wash your hands.", the echolalic speaker answers, "*Good boy*" (this example is cited from Vicker 1999). After washing his hands, his teacher typically says so to reinforce the completion of an act, which is a typical example of delayed echolalia used by children with ASD to complete the interaction in conversation.

Thus, the differences between these two types of echolalia (i.e., immediate vs. delayed echolalia) relate to the span of time between the echolalic occurrence and the speech being echoed. One is echoed immediately, and the other is repeated after a while. As for the creativity of echolalia, it can be divided into two types concerning the linguistic form of echolalic utterances: pure and mitigated echolalia.

(b) Pure vs. mitigated echolalia in children with ASD

Regarding the creativity of echolalia, it can be divided into two types: pure/exact vs. mitigated/modified echolalia. It is easy to understand that *pure* echolalia refers to the

echoed speech without any modifications, exactly as what an echolalic speaker has heard before.

As for *mitigated* echolalia, it was first defined by Pick (1924) as the slightly modified echolalic responses. The modifications on the echoed utterances include person conversions (e.g., the shift to first-person, "Did you sleep well?" "*Did I sleep well?*", Bay 1962), expansions (e.g., "When were you born?" "*When I was born? 1889*", Stengel 1947), and some other forms of modifications. Mitigated echolalic patterns are either structurally unique from or supplemental to a pure echolalic response (Fay 1967). Specifically, there are three types of modifications in mitigated echolalia: Type I, the exact echolalic segment except for pronominal reciprocation (e.g., "Where do you sleep?" "*I sleep*"); Type II, the exact echolalic sequence preceded by or followed by affirmation or negation, or by reply, remark, or query (e.g., "Where does your cat sleep?" "*Cat sleep…can't find my cat*"); and Type III, the combinations of type I and type II (e.g., "How are you?" "*Am I*", these examples are quoted from Fay 1967). On the function of mitigated echolalia, it is regarded as an indicator of developmental progress in spontaneous speech with transitional characteristics in early language stages (Pick 1924; Stengel 1947).

The review of studies on different types of echolalia above will hopefully help understand the data analysis presented in Chapter 4 of this dissertation. Briefly, deciding whether an echolalic utterance is immediate echolalia or delayed echolalia is determined by whether it is repeated immediately or after a while. On the other hand,

pure echolalia and mitigated echolalia differ on whether there are any forms of modifications to the original echolalic utterances.

2.2.3 Summary of prior studies on echolalia in autism speech

In conclusion, most prior research regards echolalia as meaningless repetitions that should be avoided, instead of functional communicative or cognitive strategy in interactions for children with ASD. Recent studies have begun to pay attention to the functions of echolalia and call for a re-definition in autism language research. Regarding the research methods, prior studies on echolalia mainly constituted case studies, applying a qualitative analysis of spontaneous speech in naturalistic settings (e.g., Wolff & Chess 1965; Dobbinson et al. 2003; Stribing 2007). Most studies were not methodologically systematic or developmentally informed, typically relying on clinical samples or single cases, hence involving too small a sample size to allow for generalizations (Tager-Flusberg 2004).

However, there is still little understanding of the underlying cognitive and functional underpinnings of echolalia. Most prior studies focus on immediate echolalia, which is easier to identify and interpret (e.g., repeating "*You want some water*" as a positive answer to "Do you want some water?"), leading to a partial and piecemeal understanding of this functionally complex phenomenon. Given the specificity of repetitive speech in ASD, research on delayed echolalia consists predominantly of qualitative analysis of spontaneous speech in naturalistic settings (e.g., Dobbinson et al. 2003; Stribling et al. 2007; Santen et al. 2013).

The challenge is to measure echolalia objectively, accurately, and quantitatively. The specificity of repetitive speech in ASD, and its informative features, are primarily obtained via clinical observations (Santen et al. 2013). The recent removal of 'language disorder' in the list of diagnostic criteria for autism, only keeping 'communicative disorders' and 'repetitive behaviors' in the Diagnostic and Statistical Manual of Mental Disorders (DSM-V, American Psychiatric Association, 2013), improvements in standardized methods for diagnosis, and advances in computational analysis (Santen et al. 2013), all call for studies focusing on the pragmatic functions of autism speech, with the combination of both qualitative and quantitative approaches, so as to study this communicative phenomenon in ASD.

2.3 Review of previous studies on formulaic language

Given the close relation between echolalia and formulae (as explained in Chapter 1), this section reviews the studies on formulaic language from different perspectives, including language use, second language learning, first language acquisition, and language disorders.

There are few publications on formulaic language in American linguistics, but many in the European tradition. Most of them focus on the classification of various types of formulaic sequences, their use in text, and their lexical characteristics. For example, Cook (2015) explored formulae from an applied linguistic perspective, Fidler (2007) showed how German scholars approach phraseology, and Burger (2010) covered both the properties of formulaic sequences and their use by European scholars.

A special journal issue presented papers discussing formulae in three fields: cognitive perspectives on formulaic language, formulaic language and pedagogical issue, and social perspectives on formulaic language (Polio 2012). In addition, there is also a volume on universal patterns of formulae across different languages. A recent book presented the studies comparing cross-linguistic investigations, mostly focusing on everyday conversations in English, Estonian, Finnish, Japanese, and Mandarin (Laury & Ono 2020). A more recent volume included a collection of formula studies from the fields of language learning, corpus linguistics, and translations, which offered new insights into theoretical and methodological aspects, and their practical applications (Trklja & Grabowski 2021). Formulaic language plays an instrumental role in the acquisition, production, and general use of language in language disorders (Van Lancker Sidtis 2012).

Formulaicity has currently received increasing attention in different research fields, such as psycholinguistics, translation, and corpus studies. Linguistic research on formulae primarily focuses on first language acquisition (i.e., formulae in typically developing children), second language acquisition (e.g., people use formulaic chunks are easier to produce by second language learners), and the use of formulaic language in adult language. Only very few studies explore formulaic language in language disorders, such as aphasia (e.g., Van Lancker Sidtis 2012) and particularly ASD. This concerns studies from different theoretical frameworks, methodological approaches, and various purposes. However, more studies are needed to explore the role of

formulaic language in autism speech, especially the studies recruiting a larger sample size of children with ASD.

This section first reviews previous studies on identifying formulaic language (2.3.1). In particular, I present the studies on formulaic language in adult language use (2.3.2), first language acquisition (2.3.3), and language disorders (2.3.4). In the final subsection, a brief summary is given to provide a conclusive picture of studies on formulae used by different groups of participants. Given the fact that very few studies explore the use and role of formulae in autism speech, the review of studies on formulaic language in adult language, child language, and aphasic language should help frame the background of formulae in autism speech in this research.

2.3.1 Identification of formulaic sequences

Formulaic sequences are defined as prefabricated chunks or pre-packaged assemblies, stored and retrieved as wholes from memory when in use, instead of being generated by grammatical rules (Wray & Perkins 2000:1, as introduced in Chapter 1). Wray's later book (2002:9) defines *formulaicity* as words and word strings that can be processed without help from their lowest constituent layer. A considerable proportion of our everyday language is formulaic, and formulae are stored in fixed or semi-fixed chunks. Usually, there should be a continuous or discontinuous of words, or at least two words in a formula (Erman & Warren 2000:31).

These may be socio-cultural emblems (e.g., 生日快乐! "Happy birthday!") or socio-communicative formulae (e.g., 喝水, "Drink some water") that are recognizable

by a wide part of the linguistic community. These fixed expressions or under-analyzed chunks that are commonly associated with particular patterns of interactional experiences related to given social scenes (e.g., parties, weddings, funerals, etc.) and communicative acts (e.g., greetings, introductions, celebrations, congratulations, etc.). In addition to fixed expressions, under-analyzed strings, as one type of formulaic sequence, are also considered by Pascual et al. (2017). Examples are memorized rhymes, songs, and chants, as well as institutionalized routines (Wray 2009).

As for the identification standards of formulae, a group of studies explored how to identify an expression is a formula. Hence, different studies supported different criteria. However, some classical studies receive broad agreement on their formula identification standards. According to Peters's (1983) criteria, a sequence is identified as a formula when it is an idiosyncratic chunk, a 'community-wide entrenchment', or when it is situationally dependent (Brown 1973; Wong Fillmore 1976; Peters 1983). Later, Wray and Namba (2003) put forward eleven specific diagnostic criteria for identifying formulaic sequences, which will be explained in Chapter 4 when introducing the criteria applied in data identification of the second study. This research followed the standard diagnostic characteristics used in prior studies (Peters 1983; Wray & Namba 2003; Wray 2009; Pascual et al. 2017) but made some adaptations based on the specific characteristics of Mandarin Chinese. In the following subsections, the studies on formulae in the adult language (2.3.2), child language (2.3.3), and language disorders (2.3.4) are reviewed, respectively.

2.3.2 Formulaic sequences in adult language

In adult language, formulaic sequences are widely used by native adults in their daily life (Crystal 1995). It is easy to find that formulaic sequences are not rare, but extremely common, and formulae are mostly used for pragmatic or communicative purposes. Formulaicity is recently taken as a central feature of everyday language use, a part and parcel of everyday speech (Van Lancker Sidtis 2012), and fixed expressions as a fundamental utterance, which builds resources for interactions (Laury & Ono, 2020). Verbatim non-actual direct speech is mainly used for restricted rhetorical purposes, like humor. For instance, saying "*I do* ring" to refer to a marriage ring, thereby using a socio-cultural verbal formula associated with the wedding vows and thus the marriage status, as opposed to using a conventional corresponding name (Pascual, 2006, 2014; Pascual & Sandler eds. 2016).

The underlying characteristic of formulaic language is widely known, because it is usually formed through a combination of well-acceptable cultural norms commonly known to the speech community. Formulaic sequences are used because this is the way people have always said it, but it is not the question of how expressions are said. Still, formulae refer to the conventions used by the whole speech community in an appropriate way (Pawley 1991:339). Furthermore, formulaic expressions usually suit particular social conditions that are more narrowed with a specified application (e.g., "Good morning" used as a greeting at a specific time before noon).

In addition, another characteristic is that the formulaic structure can be holistically retrieved by the speaker or understood by the hearer in a conversation (Győrfi 2017).

The purpose of using formulaic sequences appears to not only reduce processing loads of the speaker, but also represent interactional codes for members of the same speech community (Peters 1983:108). On their processing advantage, formulae make the work of speaking or listening easier. When speakers comprehend and produce a formula, they only need to retrieve it from memory, rather than constructing it from its components (Kuiper 1996). Wray and Perkins (2000) proposed a model to account for formulaic sequences as devices for social interaction, mainly introducing three central functions: 1) a tool for social interaction, 2) a shortcut in processing, and 3) a feature of development. Wray (2002) further supplied other functions of formulaic sequences: 1) the reduction of the speaker's processing effort; 2) the manipulation of the hearer, including the hearer's perception of the speaker's identity; and 3) the marking of discourse structure. Thus, three dimensions are concluded from the function of formulae in adult language: processing, interaction, and discourse marking.

In a conversation, formulaicity benefits the speakers and the hearers (Wray 2001). First, formulaicity aids the speakers' production, including manipulating information, reducing processing efforts, establishing a shorter processing route, and organizing the discourse. Second, formulaicity helps the hearer's comprehension, involving getting the hearers to do things, indicating the speaker's individual identity and group identity. Native adults seem to express their identities as individuals by deliberately using memorized strings and stylistic marks, revealing their identities as group members by adopting habitual ritual discourse, idiomatic conversion, and collocation of phrases (Wray 2002).

Additionally, formulae also perform discourse marking roles, which means that formulae help build the common background in the text, as devices for situation manipulation (Nattinger & DeCarrico 1992). Wray (1999: 227) summarized the forms and functions of formulaic sequences and stated that formulaic sequences are more than mere linguistic units, instead constituting a tool that can be put to many uses in different genres. Thus, a formulaic sequence helps to establish and maintain an appropriate style for a particular genre (e.g., Critchley 1970; Drescher 1994; Wharry 1996). Sometimes word strings are used repeatedly to build a particular stylistic effect (Peters 1983), like humor (Pascual 2006). Finally, researchers are also interested in the conversational purpose of formulae, as of situation manipulators. In such studies, formulae are used for thanking, apologizing, requesting, and offering (e.g., Manes & Wolfson 1981; Aijer 1996) and for demands, warnings, orders, and so on (Maslow 1968).

Also, formulaic language helps with challenging work. For example, when an oral poet creates poems, formulae play the role of being signals in poetic elaboration and formulae used as verbal art (Watkins 1992). In addition, sports commentators and auctioneers are also fond of using formulae due to the tremendous pressure in their work, and in high-pressure auctions when they need to react instantly (Kuiper 1996: 36-37). Weather forecasts also rely on formulaic phrasing, as in "*with light winds and largely clear skies, blue skies and sunshine, widespread frost*" (Crystal 1995).

However, for different speakers, such as typically developing children, formulae are also produced in their speech and commonly used in their communications,

contributing to managing or meeting their own needs differently. Studies on formulaicity in child language are presented in the following subsection.

2.3.3 Formulaic sequences in child language

In early typical child language acquisition, there is a wider occurrence and functionality of such ritualized formulae, as they are used as an adaptation communitive strategy to make up for linguistics deficiencies (Nelson 1973; Lieven et al. 1992). Using formulaic expressions may provide some young children with an alternative acquisition route into multiword speech (Lieven et al. 1992; Plunkett 1993; Wray & Perkins 2000). Brown (1973) claims that syntactic inappropriateness indicates that a word string has not been fully analyzed. Similar to the case for the function of formulae in adult language, the use of formulaic expressions is more economical and efficient than constructing novel utterances from scratch. Also, storage as wholes or as templates makes for quicker access for children (e.g., Clark 1974; Hickey 1993).

Formulaic language is also involved in one of the language processing models. Researchers usually support two models of first language acquisition, namely the holistic and the analytic one. The holistic processing model refers to children acquiring formulaic or gestalt language first and then developing to adult language. In contrast, the analytic processing model indicates acquiring rules and then reaching the adult language level. Relating to the processing model of formulaicity in language acquisition, it is agreed that there is a balance in holistic and analytic ways of

processing, from birth to adulthood (Locke 1993, 1995, 1997; Wray & Perkins 2000; Wray 2002).

In child language acquisition research, it has long been recognized that some fixed word strings can be treated as single units by young children (e.g., Bolinger 1975: 100; Plunkett 1993: 44; Crystal 1997: 244). Formulaic sequences are understood to fall into two types in child language: borrowed from input as under-analyzed strings (Clark 1974; Cruttenden 1981); or sequences of words created by the child using grammatical or lexical rules, and then stored whole as fused strings when in use (Peters 1977, 1983). Compared with novel constructions, fused forms require little processing attention and seem to be saving precious processing space (Wray 2002). While under-analyzed strings are sequences of words or morphemes, some are simply immediate repetitions, or imitations of material input children just heard (Clark 1974). Such formulaic sequences mainly include two significant types: memorized rhymes, songs, and chants on the one hand, and socialized institutional routines on the other hand (e.g., "Nice to meet you", "Thank you", "All the best" in English, and 好久不见 "Long time no see" in Chinese). Researchers agree that formulae are produced as one of the several solutions to the problem of communication before young children can talk like adults (Foster 1990; Locke 1994, 1997).

Formulaicity is reported to play a significant role in child language acquisition (e.g., Clark 1974; Wong Fillmore 1976; Cruttenden 1981; Peters 1983). Formulaicity has been characterized as a strategy of '*talking to learn*' (Clark 1982). The use of formulae in the early stages of language acquisition has been regarded as an alternative

path to develop language for some young children (Nelson 1973; Plunkett 1991; Lieven et al. 1992; Hickey 1993; Wray & Perkins 2000). As Snow (1986) clarified, the acquisition of formulae is one of the alternatives among many routes to the acquisition, which the child later segments and analyses. Frequently occurring formulae are most likely to have become fossilized (Nelson 1981). The formulae that do not frequently occur before being broken into a formulaic frame are still very significant for the child's language acquisition (Wong Fillmore 1976; Peters 1983).

In addition, formulae are '*pragmatically specialized*' and are reported to have discourse and international functions (Cowie 1988), helping with early interaction. It is reported that most language used by young children in their early stages is highly social (Lieven et al. 1992). The memorized rhymes and songs are learned and used in children's daily life and continue to function for many years (Opie & Opie 1959:17). Additionally, formulaic institutionalized expressions, such as "good night", "love you", "bye-bye", are signs of children's language development, which contribute to meeting goals in social communications (Halliday 1975:64). Children with older siblings are found to be more likely than first children to perceive language as a social tool by using a large number of formulaic chunks (Nelson 1981:173,180; Bretherton et al. 1983).

However, some other researchers disagree with formulaic roles as acquisitional aid or disagreed that formula functions in the actual acquisitional process (e.g., Bates et al. 1988). They regard formulae as useful interactional fillers only, but a linguistic 'dead-end' in language acquisition, because they found some evidence supporting that only when children mastered the grammatical rules could they use formulaic language

well. However, the 'dead-end' view is challenged by Lieven and colleagues' later research (1992), in which they report that the use of frozen phrases has a strong positive correlation with general language productivity. So, Lieven and colleagues (1992) support the idea that formulae in children's early vocabulary may actually provide an alternative route into multiword speech (1992).

In conclusion, most researchers agree that formulae are a positive indicator for the development of language and a route to multi-language stages. In addition, formulae also help with children's early interaction and play the role of a processing shortcut in child language acquisition. Thus, in some cases, the patterns of formulaicity in child language share some similarities with that in adult language.

2.3.4 Formulaic sequences in language disorders

Similar to the wide occurrence and functionality of formulaicity in child language, this is also the case for language pathology, as in Broca's aphasia (Beeke et al. 2007; Bánréti 2010; Versluis & Kleppa 2016) and autism (Naigles 2017; Pascual et al. 2017). A large number of psycholinguists or scholars in first language acquisition and second language learning have explored the special status of formulaic expressions, as discussed in the above two subsections (Kempler et al. 1999; Perkins 1999; Wray 2002). Less attention has been paid to the explorations of formulaic language in speech pathology or speech disorders, even though formulaic language plays an essential role in the evaluation and rehabilitation of language disorders (Van Lancker Sidtis 2012). Recently, the research of formulaicity has received increasing attention in different

types of language pathology, as in Broca's aphasia (Basso 2003; Beeke et al. 2007; Bánréti 2010; Versluis & Kleppa 2016), but still, little attention has been paid to the production of formulae in children with ASD (Sterponi et al. 2014; Pascual et al. 2017).

Formulaic language plays an important role in everyday communication, so speech pathologists need to pay more attention to the scope of formulaic language in human communication (Lindholm & Wray 2011; Conklin & Schmitt 2012). This subsection presents studies on formulaic language by individuals diagnosed with aphasia or autism.

(a) Formulaic language in aphasia

Aphasia is a comprehension and communication disorder with a number of different kinds of disruption to language, following damage or surgery to the language dominant hemisphere of the brain, usually the left hemisphere. In most cases, individuals suffering from aphasia have problems with language production. However, when individuals with aphasia start to produce language output again, a part of it can be retrieved immediately, as a viable channel for speech recovery (Conklin & Schmitt 2012).

Code (1982a, 1982b) has compared the production of formulaic sequences between non-fluent and fluent speakers with aphasia, and found that formulaic language is more frequently used in Broca's (non-fluent) aphasia than in Wernicke's (fluent) aphasia. Different types of formulaic language in aphasia have been explored (Caplan 1987; Van Lancker Sidtis 1987; Code 1994). Fully fixed strings are mostly

produced, for example, in “Hi, how are you doing? Fine, thank you” the entire greeting dialogue is echoed fluently (Marshall 2000). Semi-fixed strings are also uttered by individuals with aphasia in some cases, referring to those with changes in tense, person marking, or the insertion of new class items. For example, “all around the A”, “go to the B”, and “enjoy your C”, A B C is filled with formulaic constructions in the data of Wernicke’s aphasia (Gardner 1985:185). Most data in the studies of formulaic sequences in individuals with aphasia relate to fully fixed interactional expressions, such as “I love you”, “Take care”, “Have a lovely weekend”, “I don’t know”, etc.

The effect of aphasia on the comprehension of formulaic sequences has also been investigated. Van Lancker and Kempler (1987) found that individuals with aphasia perform better with the interpretation of metaphorical expressions involving formulae (e.g., conventionalized metaphorical expressions, such as set phrases), instead of literal usages. This reveals their formulaic (holistic) way of processing, not analytically.

On the functions of formulaic sequences, little research has explored the role of formulaic language in individuals with aphasia. According to Győrfi (2017), the first function of formulaicity in aphasic speech is to extract important expressions or chunks from long-term memory. Another function of formulae is the smooth understanding by reducing cognitive and processing burdens. Research reveals that people with aphasia rely more on formulaic language, when compared with the typically developing speakers, and aphasic people also use formulae in different ways. Studies show that individuals with aphasia produce significantly more formulaic language for communicative or international purposes, such as commenting or answering (McElduff

& Drummond 1991; Oelschlaeger & Damico 1998), which helps enhance social interaction (Győrfi 2017). Formulaic language has been regarded as a characteristic of aphasic speech by the clinician.

Wray (2002:252-253) reports that formulaic language in aphasia (a left-hemisphere disorder) supports the model of multiple representations. The lexical units can be simultaneously represented in more than one lexicon. For instance, "*Happy birthday*" with the individual words (i.e., *happy* and *birthday*) are stored separately in the grammatical or referential lexicons (i.e., left hemisphere), and the whole fixed word string is stored holistically in the interactional or routinized lexicons (i.e., right hemisphere). Most linguists agree that formulaic language is stored on the right side of the brain. However, formulaic language has also been frequently associated with right hemisphere activity (Springer & Deutsch 1983). Speakers with right hemisphere damage still show a substantial proportion of formulaic expressions, albeit considerably less than those with left hemisphere damage (Van Lancker & Postman 2006).

As reviewed above, formulaic language in aphasic speech shows different functions from that in child language, and its relations with speech therapy and the recovery process have been determined. Thus, the frequent production of formulaic language in aphasic speech sheds light on individuals with other language disorders, such as patients with right hemisphere and subcortical damage, patients with Alzheimer's disease, Parkinson's disease, and particularly autism spectrum disorder (ASD).

(b) Formulaic language in ASD

Another neurodevelopmental disorder, Autism Spectrum Disorder (ASD), as introduced in Chapter 1, is characterized by impaired social interaction and communication, and atypical repetitive or restrictive behavioral patterns and interests (DSM V, American Psychiatric Association 2013). Unlike the considerable interest in formulaic language seen in adult language, first language acquisition, and aphasic speech, attention paid to the explorations of formulaic language in children with ASD has been very limited. As reviewed below, the functions of formulaic expressions in conversation for children with ASD have only been explored in several recent studies.

Dobbinson, Perkins, and Boucher (2003) focused on the interactional significance of formulae and discussed the implications of formulae for acquisition and processing mechanisms in autism speech. For example, children with ASD may use socio-cultural emblems or socio-communicative formulae to refer to an entity or an individual associated with it (e.g., saying "*Good night!*" to refer to a bed, Dobbinson 2000; Dobbinson et al. 2003; Dornelas & Pascual 2016; Pascual et al. 2017; Dornelas 2018). Dobbinson and colleagues argue that formulaic language used by children with ASD may be seen as a preferential use, instead of a pathological aspect that autism speech differentiates from everyday speech (e.g., Dobbinson 2000; Dobbinson et al. 2003). Thus, the researchers support the idea that formulae can be accounted for in a similar model of the typical and atypical language acquisition.

2.3.5 Summary of previous studies on formulaic language

The studies reviewed above mainly focus on three groups of participants: adult formulaic language users (including second language learners), child formulaic language users, and aphasic formulaic language users. The research on different participants applied to the fields of language use, first and second language acquisition, and language pathology. The functions of formulaic sequences discussed in adult speech, child speech, and aphasic speech indicate the importance of formulae in language development and language use.

This sheds light on the explorations of formulae in children with ASD, who produce a high proportion of fixed entrenchments in conversation. Thus, the research gap in the study of formulaic language and autism language calls for more attention to investigating the role of formulaic language in autism, particularly in Chinese children with ASD, since there are abundant formulaic expressions in Mandarin Chinese.

2.4 Innovative aspects

This section presents the research gap on ASD research, based on the review of the previous studies on echolalia and formulae in autism speech, from the perspectives of language domain (2.4.1), research methods (2.4.2), and target language explored in prior research (2.4.3). This dissertation fills in the research gap from the above three aspects, emphasizing the innovations of this research.

2.4.1 The lack of research on pragmatic aspects of language

The syntactic properties of language have been widely studied in autism speech. Most linguistic and psycholinguistic studies pay attention to the exploration of how children with ASD acquire or use syntactic rules and how their language competence differs from that of children with other language disorders (e.g., specific language disorder) or typically developing children. Other studies focus on the acquisition of semantics or the lexicon. Researchers have been mostly interested in the level ASD children delay and the relations between their competence in semantics and syntax. Specifically, researchers have aimed to examine the association or dissociation between children's syntactic and semantic skills. Most prior studies explore what language domain children with ASD impair most in their language development than typically developing children. That is why ASD children are compared with typically developing controls in most autism language studies.

Prior studies focusing on different domains of language show that the pragmatic aspects of language are uniquely and universally impaired in autism speech (e.g., Lord & Paul 1997; Tager-Flusberg 2001; Plumet & Veneziano 2014). Meanwhile, the comparisons between children with ASD and children with other developmental or language disorders (e.g., children with specific language impairment) also support this idea. The research in other language domains (i.e., phonology, morphology, lexicon, semantics, and syntax) also agrees that the primary impairment in autism speech is the development of pragmatic skills. In addition to deficiencies in different aspects of language, ASD individuals demonstrate deficits in communication, particularly in joint

attention, eye contact, and communicative gestures (Veness et al. 2012). In the first two years of toddlers with ASD, their developmental language patterns shown in language acquisition usually predict their language development at a later age stage. Especially the acquisition of structural language, that is, the acquisition of semantics and syntax, is regarded as an indicator for later language development. This characteristic also facilitates the diagnosis of ASD at an early age (e.g., Wetherby et al. 2007; Wetherby et al. 2008).

As mentioned above, most of the prior autism language research focuses on language acquisition, including phonology, morphology, semantics, and syntax. Few researchers pay attention to the pragmatic functioning in children with ASD. However, performance in pragmatics is an essential index for diagnosis and language intervention, which should receive more attention in autism language research. Concerning different findings on language research in ASD, it is reported that there is a dissociation between grammatical language skills and communicative functioning (Tager-Flusberg 1994:198, 2005:188). It is mostly agreed that children with ASD have strengths in acquiring grammatical forms compared with the deficiencies they encounter in pragmatic functioning skills (Naigles & Fein 2017; Naigles & Tek 2017; Naigles 2021). Recently, Smith and Tsimpli (2021) have claimed that the atypical development in ASD children might reside primarily in pragmatics but not in formal language, contributing to the theoretical distinction between narrow syntax and interfaces relevant to pragmatics.

The lack of thorough understanding of the impairments in pragmatic performance calls for more studies focusing on the explorations of communicative phenomena in the speech of children with ASD. After decades of autism language research, the strengths and shortcomings in different language domains are investigated by a large number of linguists (e.g., psycholinguists and cognitive linguists). The delays in pragmatic social functions gain broad agreement in autism research. However, the misunderstandings on echolalia as meaningless repetition call for further explorations on the functional usages of echolalic utterances and the relation between formula production and general language ability in ASD, instead of the pathological default of echolalia in autism speech.

2.4.2 The lack of diversity in research methods

Concerning the research methods, the studies on communicative phenomena are mostly case studies in autism language, so the evidence for applying research findings to all individuals with ASD is limited. In addition, very few methods are applicable for the studies exploring pragmatic phenomena due to the subjective essence of such studies. Specifically, it is challenging to design an experiment to test pragmatic phenomena by using the same protocol and material for all participants, since there is significant heterogeneity in children with ASD, and in a way that the results are easily interpretable and valid. Pragmatic phenomena cannot be easily tested through a laboratory experiment, which aims at answering a yes/no question with clear-cut and objectively interpretable answers. Identifying a given pragmatic function (e.g., conversational

engagement) is much more complicated than calculating how many times or how frequently a child uses a given word or grammatical structure.

Therefore, most prior studies on echolalia are qualitative studies, using the method of discourse analysis or natural observations. Most studies investigate the spontaneous speech of children with ASD in natural settings (in spontaneous interactions with their peers, caregivers, or therapists). This raises the difficulty of collecting data from their daily interactions without specific designed experimental aims. However, because of the specificity of the participants, the quantitative studies with ASD children are difficult to conduct. It is inevitable that many language data of children with ASD should be discarded due to their invalidity (e.g., some children stop in the middle of the experimental task because they are impatient or cannot control their emotions. The high elimination rate of participants also increases the difficulty of conducting quantitative research with a large sample size of young children with ASD.

2.4.3 The lack of relative studies on Chinese children with ASD

In addition, concerning the participants explored in autism language research, most prior studies are limited to exploring echolalia in English-speaking individuals with ASD. However, Mandarin Chinese is a typologically very different language than English, with a different frequency of use of lexical categories (e.g., nouns, verbs). Also, Chinese is a context-dependent language, which shows a lexicon full of homophones, particularly indirect pragmatics with a significant frequency of indirect speech acts (Huang et al. 2009). However, there is a dramatic increase in the number

of Chinese children being diagnosed with ASD. Thus, more autism studies investigating Mandarin-acquiring children with ASD are urgently needed. Cross-linguistic pieces of evidence help further understanding of the universal patterns in child language development, and finally offer more scientific directions for language rehabilitation in the group ASD children.

Thus, this dissertation fills in the gap by conducting research on delayed echolalia, on its usages and related functions in communication by Chinese children with ASD. The sources of echolalic utterances are mostly formulaic from a socio-cultural and socio-communicative perspective. No studies to date have explored the production of formulae and its relation with general language ability in children with ASD, so it is a good starting point to investigate the role of verbal formulae in autism speech and its impact on language development for Mandarin-speaking children with ASD.

2.5 Summary

This chapter reviews previous studies on echolalia in children with ASD (i.e., the debate on the functionality of echolalia, and different types of echolalia), and the research on formulae in adult language, child language, and language disorders (i.e., aphasia and autism). At the end of each section, a brief conclusion follows on what has been studied in previous research on echolalia and formulae, and the limits of prior research. Specifically, the previous literature on echolalia focuses on immediate echolalia, in which the data were collected from naturalistic settings, so most are case studies. Researchers still hold different opinions on whether echolalia plays the role of

a pathological default or a functional strategy in communication. Concerning the research on formulaic language, previous investigations are mainly among second language learning and language acquisition. Still, the research on formulae in language disorders, particularly in children with ASD, is extremely limited but urgently needed. Then, a section displaying the innovations of the research in this dissertation follows the above two sections, from the perspectives of pragmatic aspects of language, diversity of research methods, and the language the participants speak.

Based on the findings from the systematic review of studies on echolalia and formulae, two studies are designed in this dissertation, in order to explore the functional complexity of echolalia in Chinese children with ASD, and the role of verbal formulae in autism language development. This is the first time these two communicative phenomena are investigated in children with ASD, which is theoretically and clinically significant in autism language research.

Chapter 3 Pilot study

This chapter presents the pilot study, which was designed to select the stimuli concepts and design the related stimuli images for the two main studies in the following two chapters. This chapter includes four sections: introduction, methods, results, and summary. In the section of methods, the participants, the materials, the protocol, and the procedure are introduced. In the results, participants' average familiarity scores on two categories (i.e., individuals and entities) and the frequencies of producing verbal formulae vs. common nouns are analyzed.

3.1 Introduction

The selection of the stimuli concepts via the designed online parent report (see **Appendix 1**) and the design of stimuli images are explicitly presented in this chapter. This contains the detailed familiarity scores on originally selected 50 concepts and the proportions between the production of associative verbal formulae and related nouns for each concept. This pilot study helps understand how the final stimuli concepts were selected and how the stimuli images were associated with commonly-recognized verbal formulae.

The final materials include 24 common concepts that most preschool children with ASD know and use regularly in their everyday life (e.g., toilet, teacher). After selecting 24 most familiar concepts out of 50, the images of the target 24 concepts were designed by a professional illustrator who are experienced with cartoon-style drawings.

Combining with the public knowledge on how individuals and entities are colored in daily life, the colors used in target images have also been adapted based on the review of autism research on color bias, which is expanded in the following sub-section on the design of target stimuli images.

The questions to address in the pilot study are: Do Mandarin-speaking children with ASD produce echolalic utterances or formulaic occurrences in conversation? If so, then in what situation do they produce echolalia or formulae often, or what kind of materials can elicit their echolalic or formulaic productions? Thus, in order to explore the concepts that preschool children with ASD are most familiar with and those can elicit higher proportion of formulaic sequences, this pilot study aims to design scientific materials that help elicit echolalic utterances or verbal formulae in the following two studies.

3.2 Methods

In order to answer the above questions, a survey was designed to learn about Chinese children's familiarity with ordinary individuals or entities in daily life, and productions of relative entrenched formulaic expressions associated with the human/entity based on parents' daily observations. This section presents the methods applied in this pilot study, including the participants' information, the sources of materials, the protocol, and the procedure.

3.2.1 Participants

An online survey with 50 concepts (see **Appendix 1**) was completed by 242 parents of children with ASD and normal young children mainly in four Chinese cities (e.g., Qingdao, Ningbo, Hangzhou, and Changsha). Among all the reports, 19 were eliminated due to their incompleteness. Thus, the final results consist of data collected from 175 children with ASD (Mean=60.09 months old; SD=11.24) and 48 young typically developing children (Mean=42.17 months old; SD=9.93). In total, 223 participants finished the Likert scale, and their mean age is 56.38 months old (SD=13.15).

3.2.2 Materials

To ensure that the elicitation materials are recognizable to all participants vis-à-vis their autism diagnosis, chronological age, and socio-cultural background, 50 potential stimuli concepts were initially selected. These were chosen based on the vocabulary checklist of the Putonghua Communicative Development Inventory (Tardif et al. 2008), which will be introduced in the methods of the following Chapter 4, together with the results of studies on functional echolalia by Brazilian children with ASD (Dornelas & Pascual 2016; Pascual et al. 2017; Dornelas 2018) and Chinese children with ASD (Zhao & Pascual 2017). Thus, a total of 50 stimuli concepts that are most common for children with ASD were finally selected from the abovementioned dataset, including 10 cartoon figures (e.g., 小猪佩奇 "Peppa Pig"); 14 daily human beings (e.g., 老师

"Teacher"); 16 daily objects (e.g., 生日蛋糕 "Birthday cake"); and 10 body parts (e.g., 脸颊, "Cheek").

3.2.3 Protocol

The pilot study designed an online Likert 5-point scale (see **Appendix 1**) to collect data from 223 preschool mandarin-speaking children with ASD and younger typically developing children. The pilot survey collects data from two perspectives: first, the Chinese preschoolers' familiarity with 50 concepts, and second, the related formulaic expressions that associated with the stimuli concepts. The pilot survey thus includes two questions for each stimuli term to select the concepts whose familiarity score is more than or equal to 3 scores and the concepts that may elicit the most verbal formulae based on the data analysis on the frequencies of formula production, combining with the results of familiarity.

3.2.4 Procedure

Parents could complete the survey online by opening the link: https://www.wjx.cn/jq/49852443.aspx (see the pilot parental report in **Appendix 1**). There were clear instructions at the beginning of the survey, meant to tell parents how to fill the survey, including two questions for every single item. Based on their daily observation, the parents were first asked to consider at which level their children are familiar with the listed concept (1 very unfamiliar; 2 unfamiliar; 3 neutral; 4 familiar; 5 very familiar). After the first scoring question, the parents were required to write

down any expressions their children uttered when they referred to the target entity or individual in daily life. For example, when parents point at a telephone in real life or a toy phone and ask, “What’s this?”, does the child produce the common noun directly or utter some related expressions associated with the social rituals. Specifically, does the child answer the common noun 手机 “telephone”, or say 喂，你好？ “Hello, how are you?”, 打电话 “Make a call” or some other formulaic expressions associated with the phone call situation. In the end, an additional note was also added to avoid parents reporting fake fancy data, translated as: “Please be aware that this questionnaire does not relate to your children’s language assessment, and this will be entirely anonymous, so please fill this report with your most honest, which will help us conduct the whole research. Thanks for your cooperation.”

3.3 Results

Two aspects of the results are analyzed: the selection of 24 target concepts and the design of 24 target stimuli images, which helps to design the elicitation task for the following two main studies in this dissertation.

3.3.1 The selection of target stimuli concepts

In the selection of concepts, the screening familiarity of the initially selected 50 concepts, and the production frequencies of formulaic sequences relating the initially selected 50 concepts are included.

(a) Familiarity scores of the initially selected 50 concepts

First, on the level of familiarity, **Table 3.1** lists the specific average familiarity scores of initially selected 50 items in four categories.

Table 3.1 Average familiarity scores of 50 initially selected items (n=223)

Cartoon Figures	Familiarity score	**Daily Characters**	Familiarity score	**Daily Objects**	Familiarity score	**Body Parts**	Familiarity score
Ryder	2.52	Nurse	3.34	Birthday cake	4.42	Eyes	4.66
Buck	1.89	Teacher	4.48	Chair	4.63	Nose	4.66
Peppa Pig	4.25	Delivery agent	3.05	Phone	4.77	Ears	4.67
Elsa	1.34	Sportsman	2.17	Cup	4.79	Mouth	4.68
Witch	1.44	Toddler	3.81	Eating utensils	4.68	Teeth	4.42
Donald Duck	2.14	Street vendor	2.98	Alarm clock	3.46	Cheek	4.09
Minions	1.97	Firefighter	3.18	Microphone	3.05	Hands	4.66
SpongeBob	1.97	Doctor	3.92	Umbrella	4.39	Arms	3.9
Monkey King	2.1	Traffic officer	3	Toilet	4.61	Feet	4.54
Grey Wolf	2.36	Policemen	2.98	Bed	4.81	Legs	4.28
		Lifeguard	1.77	School bag	4.67		
		Waiter	2.7	Towel	4.61		
		Bride	1.91	Car	4.67		
		Chef	2.96	Money	3.63		
				Nursing bottle	3.96		
				Key	4.38		

After selecting the concept familiarity scores, 2 cartoon figures, 9 human characters, 16 daily objects, and 10 body parts were left. First, only two cartoon figures' familiarity scores were above 2.5 (i.e., 'Peppa Pig' and 'Ryder', see **Table 3.1**), but most of the cartoon figures met low familiarity scores. It was not easy to find some commonly recognized cartoon figures, because children are fond of different cartoon styles. Also, nowadays, there are many choices on the cartoons from different countries, so children rarely share a common background with different cartoon figures, except very popular

ones, like Peppa Pig. When considering deleting the whole category of 'cartoon figures', I found that relative entrenched expressions associated with the socio-communicative rituals are fascinating by checking parents' answers for possible productions concerning Peppa Pig and Ryder. Thus, two cartoon figures were finally included. Even the average familiarity scores of the cartoon figure Ryder were less than 3, still, children produced a lot of associative expressions related to these two cartoon figures, according to the parents' reports.

Take 'Peppa pig' as an example. Children were reported to echo a lot of specific prior speech uttered by Peppa Pig in some famous cartoon episodes. Children echoed part of or the whole of the starting sentence of Peppa Pig in each episode, at least for 49 times: 大家好，我是佩奇，这是我的弟弟乔治，这是我的妈妈，这是我的爸爸。"Hello everyone, this is Peppa Pig, this is my brother George, this is my mother, and this is my father". Other mostly echoed formulaic expressions include the production of 11 occurrences of 佩奇爱跳泥坑, "Peppa loves jumping in muddy puddles" repeated from the episode *Jumping In Muddy Puddles*, and 6 occurrences of 乔治喜欢恐龙先生, "George loves Mr. Dinosaur" from the episode *Curious George's Dinosaur Discovery*. In addition, some other famous utterances were also quoted from Peppa Pig as responses, but reaching a less frequency, such as 猪爸爸看报纸, "Peppa's papa read newspapers", 乔治，救命救命！"George, help me! Help me!", 你好，波利！ "Hello, Polly! (the name of a parrot in the cartoon)" from the episode *Polly's Holiday*. All these echolalic utterances counted a high proportion compared to

the production of common nouns in the cartoon figure Peppa Pig. A similar case was related to another cartoon figure 'Ryder' in the cartoon PAW Patrol.

Second, as for the category of 'individuals', it is easy to find that 7 items' familiarity scores were above 3 and another 2 items were very close to 3 (2.98 scores for fruit seller and 2. 96 scores for chef). Thus, another one should be added except for these 9 candidate concepts. The last alternative concept of the individual was chosen based on parents' reports for other possible familiar individual items (in the parental report, there was one open question for parents to suggest other familiar concepts at the end of two categories). After calculating the results, 'bus driver' was finally chosen among the most familiar alternatives reported by many parents, as the last one selected for the category of individuals. Then, for the category of 'entities', the familiarity scores of all candidate concepts were above 3. Thus, more evidence on their production of formulaic expressions was needed to decide the final list of concepts in the category of 'entities'.

No concepts were finally selected for the last category 'body parts'. The concepts were evaluated based on the familiarity scores of the specific terms and the frequencies of producing echolalic expressions vs. common nouns for each concept. The concepts of body parts all received high familiarity scores. However, all of them were reported to elicit a deficient proportion of verbal formulae based on the frequencies on the production of formulae for each concept via the online survey. This could be because the body parts are the concepts children learned at a very early stage, so most children have acquired the names of body parts and no longer need to use associative formulae

to refer to or describe body parts. Thus, this whole category was eliminated from the final test materials.

(b) Frequencies of formula production among the initially selected 50 concepts

The materials were designed to elicit formulaic language concerning individuals (e.g., baby), professions (e.g., doctor), entities (e.g., glass), and specific fixed phrases from famous cartoons in the cases of the two cartoon characters (i.e., Peppa Pig; Ryder). To make sure the test items are familiar to all the participants and be able to induce a higher proportional production of formulaic expressions. One more selection criterion was added as combined evidence for the selection of final materials. Thus, the production of entrenched phrases associated with the concepts was counted in percentages—the proportions of formulaic expressions vs. corresponding common nouns of each concept.

The concept 'bride' was first eliminated in the category of 'individuals' because of its low proportional production of formulaic expressions. Then, the 'policeman' was also deleted because children confused it with the traffic officer, as reported by their parents. At the same time, the traffic officer gained a much higher percentage of formulaic utterances (63% vs. 18%) and a little bit higher familiarity score (3 vs. 2.98) than the policeman. Thus, the traffic officer was chosen while the policeman was eliminated. Third, 'waiter' was also deleted as one of the three concepts that elicited the lowest proportions of formulaic expressions. Finally, 'lifeguard' elicited a relatively high percentage of formulaic language (54%), but its familiarity was very low, counting for 1.77 only. This is reasonable since the participants in this research do not live near-

sea cities, so most of them are not familiar with this profession. In the end, 'bride', 'policeman', 'waiter' and 'lifeguard' were eliminated from the category of individuals (as listed in the last four items of **Figure 3.1**).

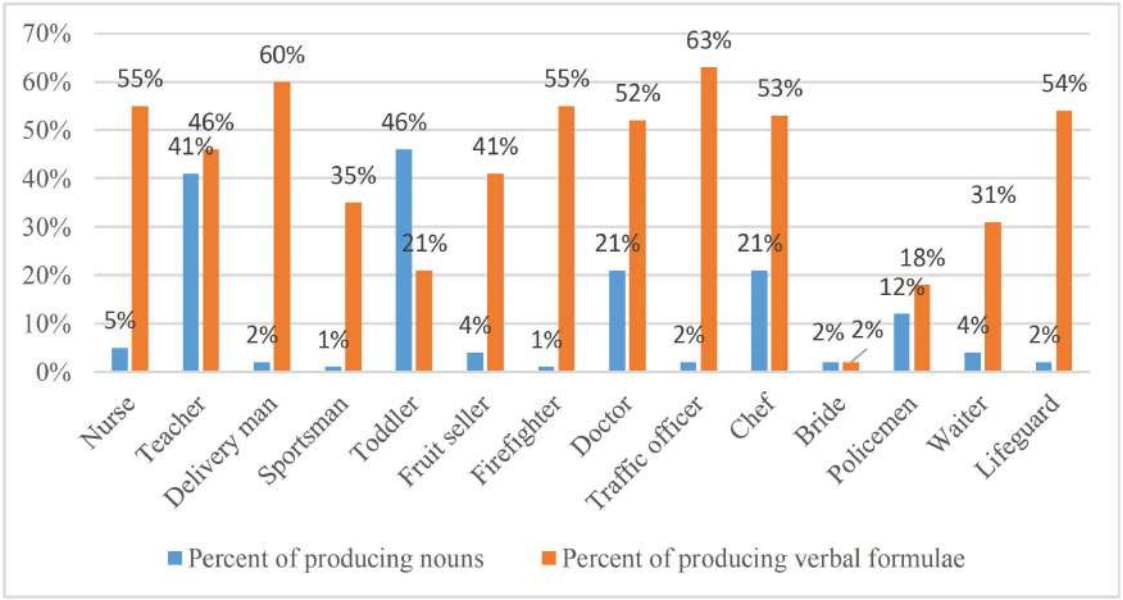

Figure 3.1 Production of verbal formulae vs. nouns in the category of 'Individuals'

Take the profession of 'firefighter' for example (see **Figure 3.2**). Children produced 112 occurrences of verbal formulae associated with the firefighter, including 70 occurrences of 灭火 "Put out the fire", 35 occurrences of 着火 "It's on fire', 3 occurrences of 救命啊！ "Help me!", 2 occurrences 报警 "Call the police" and another 2 occurrences of 喷水 "Spray water". All these formulaic expressions make up 55% of the whole production. Conversely, children only produced 19 occurrences of nominal names, that were 消防员 "Firefighter" and 4 occurrences of class noun 叔叔 "Uncle", making up only 1% in the dataset of productions on the firefighter. The comparisons between the production of formulaic sequences and common nouns were

presented in percentages, as shown in **Figure 3.1** above (55% vs. 1%). Here **Figure 3.2** offers more detailed information about what types of verbal formulae vs. common nouns are usually produced with the concept 'firefighter', which offers further evidence and solid support for selecting the concepts in the category of 'individuals'.

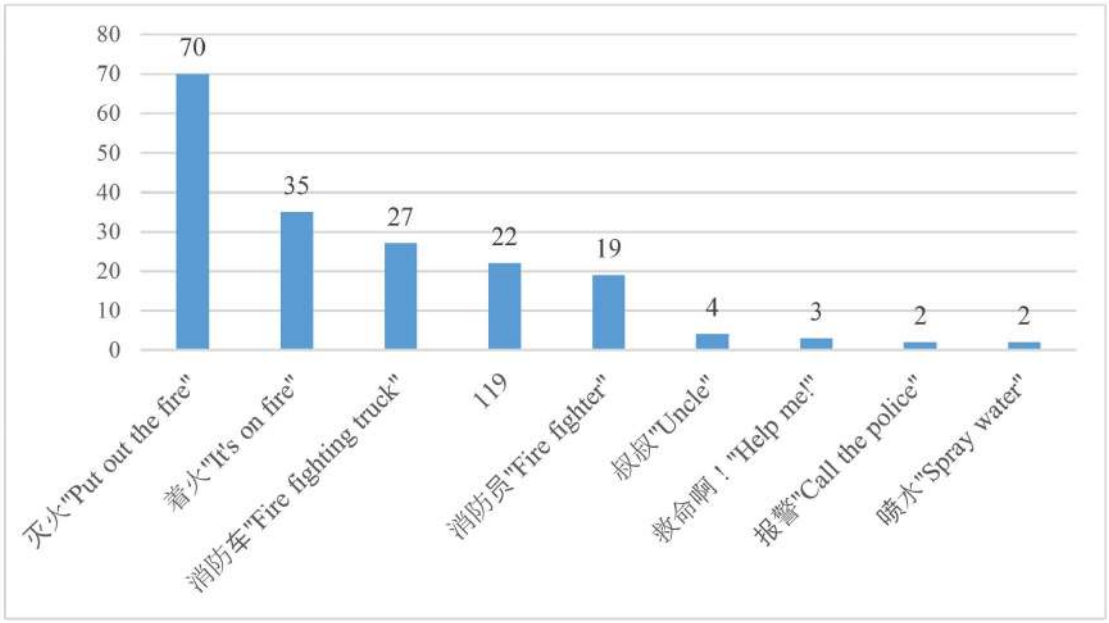

Figure 3.2 Production of verbal formulae and nouns associated with 'firefighter' in the category of familiar 'Individuals'

In the category of 'individuals', **Figure 3.1** introduces the general information on all alternatives for individuals, which gives a clear picture of which one elicited more formulaic expressions and fewer nouns. This helps readers understand how the final materials for 'individuals' were selected. **Figure 3.2** lists 'firefighter' as a specific example on the category of individuals, revealing what kind of formulae and nouns are usually produced associated with the target concept in the category of individuals.

As for the category of 'entities', the items whose percentage of echolalic expressions being more than 50% were perfect candidates for the final materials. For those items whose percentage of formulaic production being less than but around 50% (the formulaic production of 'birthday cake', 'microphone', and 'car' counted 47%), the relative proportion of corresponding common nouns would be calculated as a comparison. If there were significant differences between the production of nouns vs. formulaic expressions, such concepts would also be selected despite their familiarity scores being slightly lower than others. For example, the percentage of nouns associated with the birthday cake is 21%, the microphone is 6%, and the car is 12%. The differences between the proportions of formulaic expressions and nouns reached great significance (*p*s<.001). This means that these concepts elicit significantly more formulaic sequences than proper nouns, which was the desired result in the pilot study. Thus, the final concepts for the category of 'entities' were also selected based on the combined evidence of familiarity scores and the proportions of formulaic productions. The proportions of formulaic expressions vs. corresponding nouns in the category of entities are presented in detail in **Figure 3.3** below.

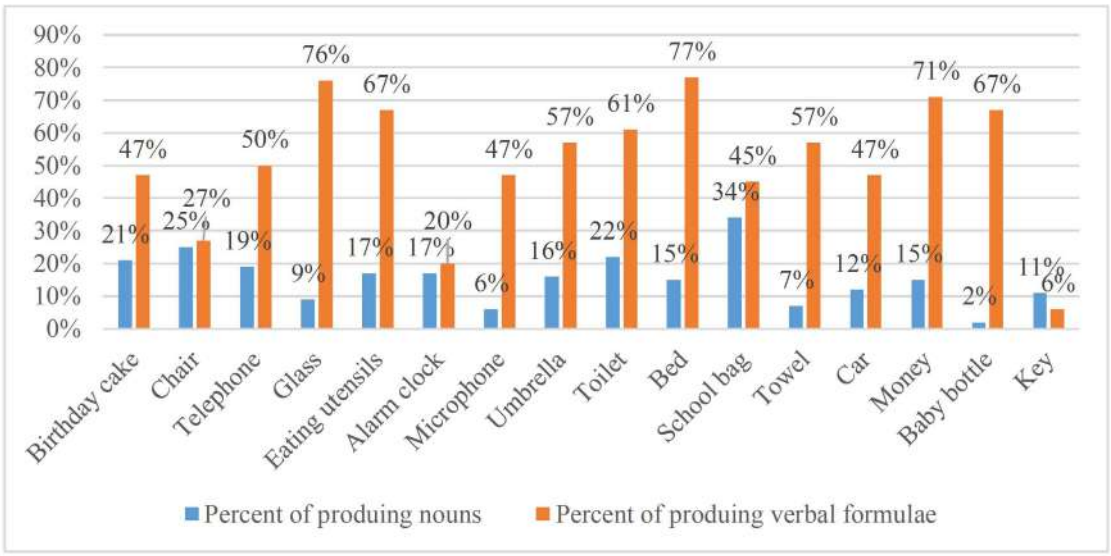

Figure 3.3 Production of verbal formulae vs. nouns in the category of 'Entities'

Take the object 'glass' as an example (see **Figure 3.4**), children were reported to produce 164 occurrences of verbal formulae 喝水 "Drink water", 8 occurrences of 倒水 "Pour water", 7 occurrences of 喝牛奶 "Drink milk", 2 occurrences of 干杯 "Cheer" and another 2 occurrences of 喝茶 "Drink tea", all these formulae mostly describing drinking scenes are closely related with glass, which together makes up 76% of the whole production. On the contrary, children were reported only to produce 19 occurrences of nominal names, making up less than 9%. The comparisons between the formulaic sequences and common nouns of 'glass' are presented in **Figure 3.3** above (76% vs. 9%). Here, **Figure 3.4** presents what kind of verbal formulae were usually produced associated with glass, which offers much information for selecting the target concepts for the category of 'entities', and also offers a bright picture for the possibly elicited formulaic expressions by the selected materials.

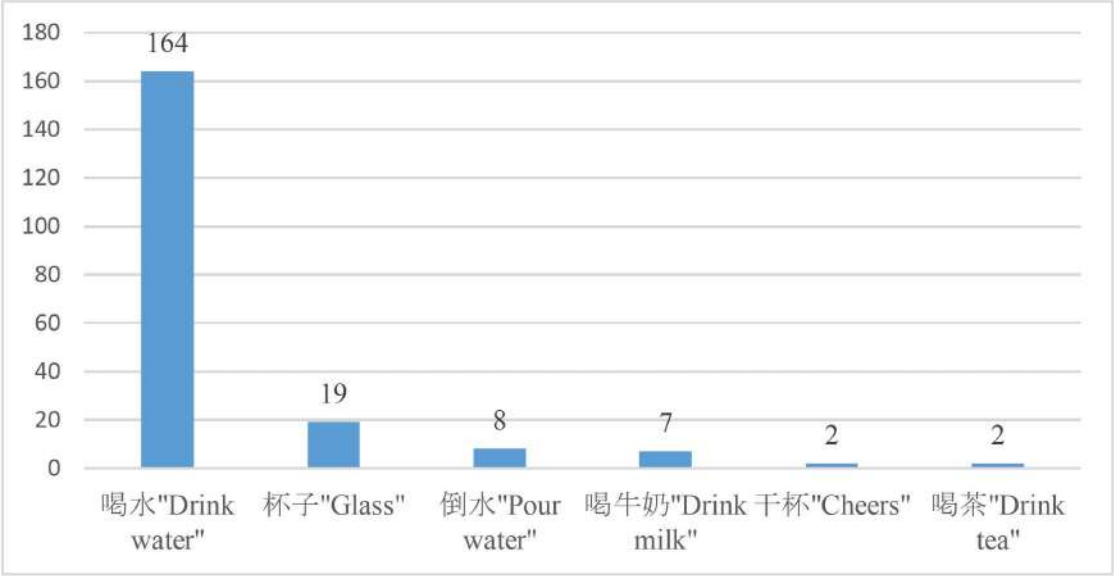

Figure 3.4 Production of verbal formulae and nouns associated with 'glass' in the category of familiar 'Entities'

In conclusion, after evaluating the average familiarity scores and the calculations of word frequencies of formulaic expressions on all those 50 concepts, 12 concepts of individuals or cartoon figures and 12 objects were finally selected after the two scientific selection procedures, as presented in **Figure 3.5** below.

3.3.2 The design of target stimuli images

Upon studying the results of this parental pre-test presented above, 24 concepts were finally selected as elicitation materials for this research. These were: 12 professions or cartoon figure individuals (e.g., teacher, toddler, Peppa Pig) and 12 entities (e.g., birthday cake, telephone, glass). These concepts are what children are most familiar with and are commonly associated with lots of fixed expressions in Mandarin Chinese (e.g., 打针 "Give an injection" for the nurse; 生日快乐 "Happy birthday!" for the cake).

The images were all designed very carefully, on their facial expressions and eyesight directions and the colors used in the images. It was reported that the processing of cartoon images requires less social information (van der Geest et al. 2002), so cartoon images were used instead of photographs of real people and objects in this research. Also, the processing of human faces was reported to be abnormal in ASD, and they especially avoid eye contact. So, all the individuals and entities in the images were not physically facing forward and looking ahead but standing sideways at a 45-degree angle.

Furthermore, there is a color bias in the preferences of children with ASD. As reported, they have similar processing patterns to the colors red, blue, and pink. Thus, these three colors were used in most cases when they suited the typical images of ordinary objects or persons in real. The colors they love most or hate most were avoided in all the drawings in order to design neural visual stimuli and avoid any bias during the elicitation task. The final test images are presented in **Figure 3.5** (see **Appendix 2** for the images in larger size).

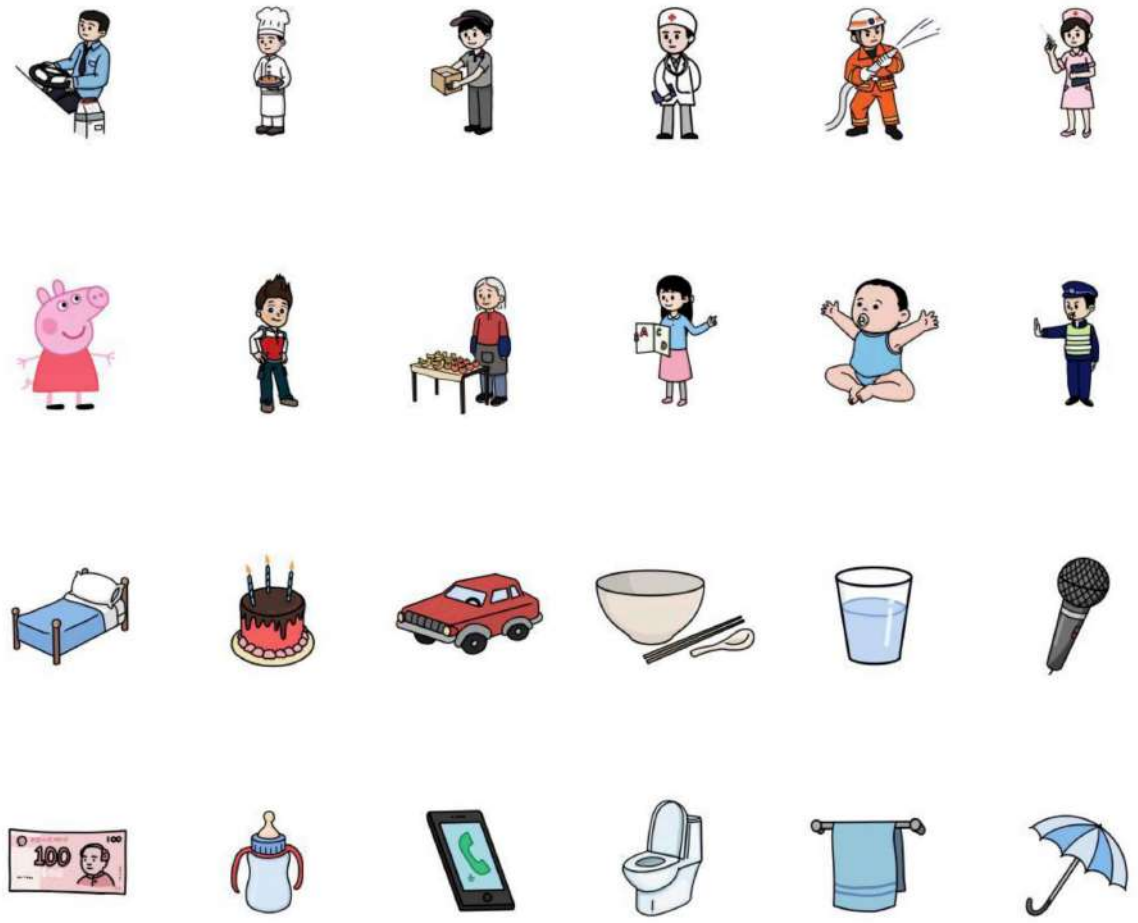

Figure 3.5 Stimuli images (12 professions or individuals and 12 entities)

3.4 Summary

In conclusion, this chapter introduced the pilot study, that is, the designed Likert scale on the participants' familiarity with the concepts and potential elicited formulae associated with the related concepts (see **Appendix 1**). In addition, the selected 24 concepts were designed as stimuli images that Chinese children with ASD could recognize well. Thus, the concepts and related images had received scientific considerations in the pilot study. The results of this pilot study offered useful

information about the individuals and entities that most Chinese children with ASD are familiar with before 6 years old, which helps with the design of the two main studies.

The following chapter presents the first main study of this dissertation, that is the exploration of functional usages of echolalic utterances produced by Chinse children with ASD.

Chapter 4 Functional Usages of Echolalia in Children with ASD*

This chapter presents study 1 on the exploration of specific functions of echolalia used in the speech of 8 children with ASD. Five sections are included in this chapter, they are: introduction, methods, results, discussion, and summary. This chapter first introduces the objectives and questions of this study. Then, the section of methods presents detailed information about the eight echolalic children tested in this study, and also introduces the standardized measures, the materials, the protocol, and the procedure. The results include both the qualitative and quantitative data analysis, revealing that echolalia may play the role of cognitive or communicative strategy in the conversation for Chinese children with ASD. After the results, the main research findings and related implications of this study are discussed.

4.1 Introduction

As introduced in Chapter 1, this study was designed to answer two main research questions: 1) Are the echolalic utterances produced by Chinese children with ASD functional or simply pathological? 2) If they are functional, then how do ASD children use different types of echolalia and echolalia with different functions to manage the conversation, when the children have communication difficulties?

* This chapter mainly presents the data analysis from the paper "Functional echolalia in autism speech: Verbal formulae and repeated prior utterances as communicative and cognitive strategies" (in preparation), which was written together with Esther Pascual and Todd Oakley.

Echolalia, as introduced in Chapter 1, is defined as the literal repetition of others' prior speech, is a typical characteristic of autism (Kanner 1946; Prizant & Rydell 1984;). According to Dornelas & Pascual (2016) and Pascual et al. (2017), echolalia constitutes standard linguistic formulae (i.e., socio-cultural emblems and socio-communicative formulae), and repeated given prior utterances (i.e., specific prior enunciation). Concerning the function of echolalia, it has long been considered meaningless repetition to be avoided, but it may in fact be used functionally in autism speech (Roberts 2014; Sterponi & Shankey 2014), as reviewed in Chapter 2 on the debate.

This study is based on a prior naturalistic Brazilian study of echolalia in autism conversation (Pascual et al. 2017) and a follow-up study (Dornelas 2018). In these two studies, all the usages of echolalia by the ASD children are functional, and the formulae are all understood by their interlocutors. The difference in the use of echolalia between the autism and the young typically developing group is principally one of quantity (e.g., the autism group produces less creative speech), both groups using it as a communicative strategy for similar functions.

Thus, this study explores the specific functions of echolalia used by Mandarin-speaking verbal children with ASD via an elicitation experiment, in which participants are asked to name and describe the stimuli images. This study investigates the functional complexity of echolalia in autism conversation, to deepen our understanding of how this pervasive phenomenon functions in standardized contexts. Hence, the goal of this study is not to compare neurotypical to neurodivergent speakers, but to explore how children with ASD use echolalia as cognitive or communicative strategy to

successfully answer questions or manage a conversation. This study focuses on the production of echolalic utterances used functionally by children with ASD, including both widely identified verbal formulae and specific prior enunciations that can only be recognized by close circles of children with ASD.

By combining a qualitative and quantitative analysis of the echolalia data, this study examines the types of echolalia, its most common sources, its proportion vis-à-vis referential and descriptive alternatives, and the specific functions ASD use in conversation. The results show that all the participants with ASD produce a relatively high proportion of echolalic utterances, mostly for naming, description, and topic development, a small percentage being used as conversation maintenance strategy or cognitive strategy. This indicates that echolalia is often used successfully and functionally in autism speech. The results offer abundant prototypical examples involving echolalia produced by Chinese children with ASD, which finally constitutes integrated models of types and functions of echolalia that could be used for ASD assessment and treatment.

4.2 Methods

In order to answer the above research questions, this study applies a combining research methodology to analyze the abundant language data produced by children with ASD, containing both the standardized measures and the designed elicitation experiment. The first subsection introduces the main contents of the two standard assessments, constituting the Autism Behavior Checklist (ABC, Krug et al. 1980; 杨晓玲等 1993)

and the Putonghua Communicative Development Inventory-Words and Sentences (Tardif et al. 2008). After that, the participants' information is presented, containing the basic information on chronological age, gender, therapy time length, and the participants' further information assessed via the ABC and CDI. In the following subsections, the materials, the protocol, and the procedure are explicitly presented.

4.2.1 Standardized measures

In this section, two standard tests are introduced. They are: the Autism Behavior Checklist (ABC), and the Putonghua Communicative Development Inventory (PCDI)-words and sentences. Detailed contents of the two standardized tests are explained, and the participants' scores on each inventory are reported in the following subsection.

(a) The Autism Behavior Checklist

The Autism Behavior Checklist (ABC; Krug et al. 1980) is a scientific diagnostic instrument for autism that has been widely used in autism research. The Autism Behavior Checklist can provide reliable information on how an individual performs compared to others, reflecting an individual's challenges to respond appropriately to daily life situations. The features of this checklist make it an attractive and applicable assessment instrument. Either teachers or parents could be the raters. Thus, the ABC is designed as a parent/teacher rating scale to screen for autistic behaviors of individuals from 18 months to 35 years.

To gain more detailed information about the participants' background information and their delays in different behavioral domains, participants' parents were asked to report on their children's levels of autism by filling out the ABC. Parents who finished the ratings were unaware of the purpose of the checklist, the weightings of items, and the item groupings. Furthermore, these ratings were made with the assistance of the experimenter and implemented independently by individual therapists who had the most experience with each participant when the caregivers' ratings didn't meet significant reliability.

Specifically, the ABC contains 57 items selected from various sources, which are grouped in five behavioral areas: sensory behavior (e.g., sometimes painful stimuli such as bruises, cuts, and injections evoke no reaction; n=9 terms), relating behavior (e.g., not responsive to others' facial expressions/feelings; n=12 terms), body/object use behavior (e.g., twirls, spins, and bangs objects a lot; n=12 terms), language behavior (e.g., uses at least 15 but less than 30 spontaneous phrases daily to communicate; n=13 terms), as well as social and self-help behavior (e.g., prefers to manipulate and be occupied with inanimate things; n=11 terms).

The items are dichotomous (i.e., yes/no) but are assigned weights from 1 to 4. The higher the children's ABC score, the greater their impairment is. In the Chinese version of the ABC, it was reported that individuals with a total score of 62 or higher are highly likely to suffer from ASD, while the cut-off score is 31, which helps distinguish children who are questionably autistic from those unlikely to be autistic (杨晓玲 et al.

1993). The ABC is one of the most frequently used scientific screening assessments in studies of ASD in mainland China (Sun et al. 2013; Su et al. 2014, 2018).

(b) The Putonghua Communicative Development Inventory (PCDI)-words and sentences

The MacArthur Communicative Development Inventory (MCDI; Fenson et al. 1993), parent report measures, administered in the questionnaire or interview format, can provide helpful information about a child's language skills that may not be observed in a laboratory or clinic setting (Targer-Flusberg et al. 2009). The MCDI is the most widely used inventory for language assessment to measure early language development in English-learning children. A large body of evidence supports the reliability, validity, clinical utility, and research potentials of the MCDI and its translated versions in more than 90 languages.

The Putonghua Communicative Development Inventory (PCDI, Tardif et al. 2008) is the Chinese version of the MCDI. The Putonghua version adapted to Mandarin Chinese is a standardized measure intended for Chinese typically developing children between 8 and 30 months of age (Fenson et al. 1993), but it can also be used for older children with language delays (Charman et al. 2003; Luyster et al. 2007). This has been successfully used as a scientific inventory to assess the general linguistic abilities of Chinese children with ASD (谢帆 & 苏怡 2016; 苏怡 & 谢帆 2018; Su et al. 2018; 谢帆 2018).

The PCDI is designed to include parent-reported information on language and communication development in infants and toddlers, which measures the child's language comprehension and production abilities (Mitchell et al. 2006). Specifically, the PCDI (Tardif et al. 2008) is composed of two scales: the PCDI-Words and Gestures (initially designed for 8-16-month-olds typically developing children) and the PCDI-words and sentences (initially designed for 16-30-month-olds typically developing children). The PCDI-Words and Gestures includes a subscale of receptive and expressive vocabulary, consisting of 411 words, plus questions about communicative gestures and imitation of daily activities. The PCDI-words and sentences, used in this research, includes an expressive vocabulary subscale, containing 799 words from 26 semantic categories, plus a subscale of grammatical categories including questions about the command of grammatical categories, such as the use of tense and case markers.

Tardif and colleagues (2008) conducted a large norming study in the Xicheng and Dongcheng district of Beijing to establish age-appropriate norms for both scales. A total of 636 children aged 8-16 months formed the norming sample for the PCDI-Words and Gestures subtest, while 1056 children aged 16-30 months formed the norming sample for the PCDI-words and sentences subtest. The reliability and validity of the PCDI forms have also been verified in the above-noted standardized studies. The PCDI forms have also yielded high internal consistency (Cronbach αs=0.84-0.99) and moderate-high test-retest reliability (rs=0.45-0.93, *p*s<.001). As for the validity of the PCDI forms, the inventory presents sound content validity, convergent validity, as well

as good concurrent validity with other language measures such as the speech section (but not the performance section) of the Gesell Development Scale (rs=0.30-0.78, *p*s<.10).

The sub-scale used in this dissertation is the PCDI toddler form, that is the PCDI-words and sentences, which contains two parts. Part I is a vocabulary checklist (799 items, organized into 24 semantic categories, e.g., nouns, verbs, classifiers, pronouns, questions words, etc.), testing the number of words the child can produce. Part II involves questions about sentence use and grammatical markers: 1) The decontextualized language (how children use words; e.g., when parents ask "Where is the little bear?", if the teddy bear is in another room, will the child go looking for it?; n=5 items: 4 production items and 1 comprehension item); 2) The use of grammatical morphemes (including the use of grammatical markers in the subcategory of 'sentences and grammar'; e.g., when talking about events in the past, has the child started to use the aspect marker 过 *guo* or 了 *le*? For example, 去过 *qu guo* "have gone", 吃了 *chi le* "have eaten"; n=4 items); 3) The ability to combine words (Mean length of utterances MLU, i.e., list three longest sentences the child has said; n=3 items); and 4) Sentence complexity (e.g., if the child wants someone do something for him, does he say "tell", "mommy tell", "mommy tells stories", "tell stories to baby", or "mommy tells stories to baby"; the parent was asked to choose one which best reflects the child's current speech level; n=27 items). The detailed description for the PCDI-words and sentences is presented in **Table 4.1**. Thus, the sub-scale scores on vocabulary and

grammar provide readers with further information on the general language ability of children with ASD in this dissertation.

Table 4.1 The subsets of PCDI-words and sentences (Tardif et al. 2008; adapted from Table 2 on page 3439 in Su et al. 2018)

Subtest (number of items)	Description
Part I	
Vocabulary checklist (799 items)	Checklist of words the child can say, organized into 24 semantic categories
Part II	
A. The decontextualized language (5 items)	Questions on how the child uses the decontextualized words, i.e., the frequencies of the child's references to the absent toys/animals; absent possession; past events/people; and future events
B. The use of grammatical morphemes (4 items)	Questions about how the child uses grammatical language. i.e., the use of serial verb construction; possessive; quantifier; and aspect marker
C. The ability to combine words (1 item)	Question on whether the child can combine words into sentences
Mean length of utterances (MLU) (3 items)	The list of 3 examples of the longest sentences uttered by the child.
D. Sentence complexity (27 items)	The selection of one from a pair of sentences contrasting in complexity to indicate how the child currently speaks

In the following subsection, the participants' basic background information is presented, including their age in month, the time length of their receiving therapy, their rating scores on the ABC, and their total vocabulary production scores and the scores on commanding grammatical categories on the PCDI.

4.2.2 Participants

In this study, 8 Mandarin-speaking preschool children with ASD were recruited from Zhejiang provincial children's early intervention center - "Green Apple Home" in

Hangzhou, aging from 3 to 6 years old (mean age=55.50±8.64). All these children had been previously diagnosed by experienced child psychiatrists and had met the diagnostic criteria of the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM V; American Psychiatric Association 2013) as well as by the relevant clinical evaluation and observation. The diagnosis was also supplemented with a Chinese autism screening instrument, namely the parent rating scale of the Autism Behavior Checklist (杨晓玲 et al. 1993).

The reason why only eight participants were tested in this study is that the pragmatic and child-specific nature of the object of this study required a close observation of the data for metalinguistic cues as well as numerous, lengthy consultation sessions with parents or therapists. Thus, eight echolalic children who produced abundant language data were selected for this study to explore the functional usages of echolalia in autism speech.

The basic information of the participants is shown in **Table 4.2**, containing age in months, length of therapy time, total vocabulary scores on the PCDI, and the age of vocabulary-matched typically developing children. Following the norms established in Tardif et al. (2008), the PCDI vocabulary production scores of these eight Chinese boys with ASD, as demonstrated in **Table 4.2**, can be matched to typically developing Chinese boys at 25 months of age (vocabulary production scores: ASD: 607±175.47 vs. Typically Developing 25 months: 609±224, t=0.194, p=.849>.05, d=13). The comparison with their vocabulary-matched typically developing children shows

readers a more comprehensive picture of the participants' language abilities from a developmental perspective.

Table 4.2 Characteristics of 8 participants with ASD and the matched typically developing (TD) children in Tardif et al. (2008)

ASD (n=8)	**Age in months**	**Therapy time length** (in months)	**PCDI vocabulary production scores in ASD**	**PCDI vocabulary production scores in matched TD children in the norms by Tardif et al. (2008)** (n=35)
Mean	**55.50**	17.13	607	**TD 25 months**: 609
(SD)	(8.64)	(9.70)	(175.47)	(224)
Range	47-70	3-24	227-779	241-781

(a) Participants' delays in five behavioral domains assessed via the ABC

The parental rating scores of the participants on five sub-scales of the ABC are presented in **Table 4.3**, showing the specific scores of 8 high-verbal boys' delay in five behavioral domains, aging from 3;11 to 5;10 (mean=4;7). Their total ABC scores are 49.13 (SD=12.98) on average, ranging from 31 to 65. Specifically, these 8 participants involve two cases of what could be considered 'severe' autism (Child 3 HQH and Child 5 SCN), four so-called 'moderate' cases (Child 2 YLX, Child 4 SHX, Child 6 NZQ, and Child 8 LFY), and two 'mild' cases (Child 1 YCQ and Child 7 HH).

Table 4.3 Specific ABC scores of 8 participants on five subscales of the Autism Behavior Checklist (ABC)

ASD (n=8)	Sensory (n=9)	Relating (n=12)	Body/object use (n=12)	Language (n=13)	Social/self-help (n=11)	Total (n=57)
Child 1	0	7	3	18	4	32
Child 2	8	20	4	20	7	59
Child 3	15	14	3	24	9	65
Child 4	7	9	8	17	7	48
Child 5	3	17	7	17	17	61
Child 6	3	7	5	20	6	41
Child 7	7	7	3	9	6	32
Child 8	7	7	15	10	16	55

(b) Participants' general language ability assessed via the PCDI-words and sentences

The scores of general vocabulary size and grammatical competence were evaluated by having the children's parents complete the Putonghua Communicative Development Inventory: Words and Sentences (Tardif et al. 2008). **Table 4.4** shows that the mean scores in the lexical categories of nouns and verbs are relatively high. Still, the scores in the other three categories only reach half of the total scores, and some children even got zero in the production of pronouns, classifiers, and question words. This shows that open class words (i.e., nouns and verbs), which comprise the primary production in the elicitation task, are more accessible to the participants than closed class ones (i.e., pronouns, classifiers, and question words), which seems to indicate that semantic words are more accessible than functional words for children with ASD to acquire.

Table 4.4 PCDI vocabulary production scores

	Five Lexical Subcategories				
ASD (n=8)	**Nouns** (n=371 items)	**Verbs** (n=194 items)	**Pronouns** (n=24 items)	**Classifiers** (n=20 items)	**Question words** (n=12 items)
Mean (SD)	317.88 (63.55)	133.63 (55.48)	11.75 (8.26)	11.63 (6.61)	7 (4.57)
Range	180-368	20-190	0-23	0-20	0-12

In addition, **Table 4.5** presents their mean length of utterances and sentence complexity compared to the norm, revealing no significant differences between these 8 participants, averaging 55 months, and the vocabulary-matched typically developing children at 25 months of age (p=.150>.05). Even though these eight children with ASD are relatively high-verbal, who produce a large amount of language data, their language development still delays a lot compared with the typically developing children in the norm of Tardif et al. (2008).

Table 4.5 Mean Length of Utterance (SD) and sentence complexity scores of the participants with ASD and the matched typically developing (TD) children in Tardif et al. (2008)

Grammatical Categories	**ASD 55.5 months** (n=8)	**TD 25 months** (n=35)	**t**	**d**
Mean Length of Utterance	6.29 (3.61)	-	-	-
Sentence complexity (n=27)	55.13 (24.71)	51.9 (22.9)	1.353	26

Thus, while the participants possess a robust vocabulary and well-developed and complex sentence structure, they still lag behind their vocabulary-matched typically developing toddlers for at least an average of 30 months.

4.2.3 Materials

The materials used in this study were selected after careful procedures by exploring the concepts' average familiarity scores and the potential echolalic utterances elicited by the items, as presented in the above Chapter 3. In addition, the design of the related 24 stimuli images was also cautiously, in order to design neural experimental materials for the participants with ASD. Thus, the final materials contain 12 professions or individuals and 12 entities that children with ASD are familiar with in their daily life. For more detailed information about the materials, please refer back to **Figure 3.5** in Chapter 3.

After the elicitation task, the parents were asked to fill a five-point Likert scale with the designed test images on the participants' familiarity with the concepts and level of recognition of these finally designed images (see **Appendix 2**). This screening was administered after the task to prevent information contamination. All the 8 participants in this study were reported to be quite familiar with the concepts (Mean=4.10, SD=0.47) and to be able to recognize the images correctly (Mean=4.14, SD=0.44). The mean scores and the range of the familiarity and recognition scores indicated that all the participants in this study were very familiar with the test concepts and could recognize relative designed visual images very well.

4.2.4 Protocol

An elicitation experiment involving the carefully designed 24 concepts and related stimuli images was designed in this study, to elicit as many as echolalic utterances produced by Chinese children with ASD.

In this study, the visual stimuli (as presented in Chapter 3) were presented by the experimenter on an iPad. In order to counterbalance the impact of the order in which each image appears in the sequence, all stimuli images were randomized automatically, generating four different versions of the sequence, with no images from the same category appearing continuously. All participants had to answer two questions on each in Mandarin, one was a request to name what was represented in the image (i.e., 他是谁？/这是什么, "Who's this?" / "What is this?") and the other was an open question on the individual or the object's functionality (i.e., 他会干什么？ / 这个可以用来干什么？ "What does s/he do" / "What's it used for?"). An average of five seconds was left between the first appearance of an image and the first question to allow time for the participants to shift attention and focus on the new test image.

The entire task was video and audio recorded in a quiet room in the autism center where the participants with ASD receive daily therapy, which comforts them most. It took an average of over 14 minutes for each participant, the total time for all participants being 115 minutes and 35 seconds. A parent of each child taking the test was present, sitting approximately three meters from the child and keeping silent throughout the task. The presence of a parent was meant to calm the child down and

facilitate querying about their children's ambiguous or hard-to-interpret responses. The consultations with the parents after the test were also recorded.

(a) Identification criteria

As for the criteria for identification of echolalic utterances, this study first adopts the fundamental definition of echolalia as involving previously encountered word strings, following the standard diagnostic characteristics used in prior research (Sterponi & Shankey 2014; Sterponi et al. 2014; Pascual et al. 2017). Combining the evidence from multi-modal cues, including the participants' language and gestures in the experiment and the parents' or therapists' interpretations, the critical criterion of identifying an echolalic utterance is that it's previously encountered. One needs to be decided if there is a significant probability that the speaker had encountered the expressions before, from other people (e.g., 日常用品类 "Things for daily use", which was heard from the sessions given by the language therapist in the autism center). Or, if the word string could be acquired as a unit from other people, probably family members. Thus, these criteria were applied in the data identification.

In applying the above criteria to the dataset, two native speakers of Chinese took the job as coders (the author and a Master's student who researches Chinese linguistics). Additionally, Dr. Pascual (the author's supervisor) checked the coding based on the English translations and discussed doubtful cases with two assessors. Despite the objective criteria illustrated above, the criteria employed to identify formulaic language also partly depend on the researcher's intuition as a native speaker. Thus, in the data

identification, the corroborating evidence both from the context and metapragmatic information, the parents' and therapists' informed interpretations, and the coders' judgments as native speakers, should be combined.

(b) Classification criteria

This study classifies the elicitation data from the perspectives of forms, types and functions of echolalia. The forms of the participants' productions include: common noun; echolalic utterances; verbal tics; statement; unrelated or meaningless responses; iconic gesture; creative enactment; unintelligible. In addition, the types of echolalia differ in: span of time (immediate echolalia vs. delayed echolalia), level of creativity (pure echolalia vs. mitigated echolalia) and source (wide community recognition: fixed expressions all members of the community recognize; specific group recognition: specific prior interaction most members of the community recognize; close circle recognition: specific prior interaction only the child or his close circle would recognize).

In relation to the function of echolalia, functional, non-functional, and semi-functional echolalia are classified. In the data, echoes of previously heard enunciations are mostly used functionally, either question-oriented or conversation-oriented. Some echoed occurrences related to the images are produced before the experimenter's question and are thus free associations coded as semi-functional echolalia. There are also echoed utterances used for no apparent communicative or cognitive function, coded as non-functional echolalia.

It should be noted that several echolalic enunciations preceding the first question on a stimulus image may not be free associations but instances of anticipatory question-oriented functional echolalia. Halfway through the task, most children seemed to have internalized the pattern and order of questioning. In some cases, such echoed utterances preceding the first question were nevertheless appropriate answers to the test questions. Therefore, many such occurrences might be covert examples of functional question-oriented echolalia. They were finally coded as semi-functional free associations instead, simply because, after examining the recording, limited non-verbal indicators (e.g., gaze, body posture, etc.) were found for the coders to be completely sure about their specific communicative function.

4.2.5 Procedure

Before this study, the parents of participants were asked to complete and sign an informed consent form, indicating their agreement in participating in this research. Also, the parents completed the Words and Sentences form of the Putonghua Communicative Development Inventory (PCDI; Tardif et al. 2008). The PCDI, administered in a questionnaire or interview format and measured via parental reports, can provide helpful information about children's language skills that may not be observed in a laboratory or clinical setting (Tager-Flusberg et al. 2005). Then, the children with ASD participate the elicitation task, responding to the naming and the description questions when looking at the 24 designed stimuli images (as shown in

Chapter 3). The procedures are displayed in the following visual flowchart (see **Figure 4.1**).

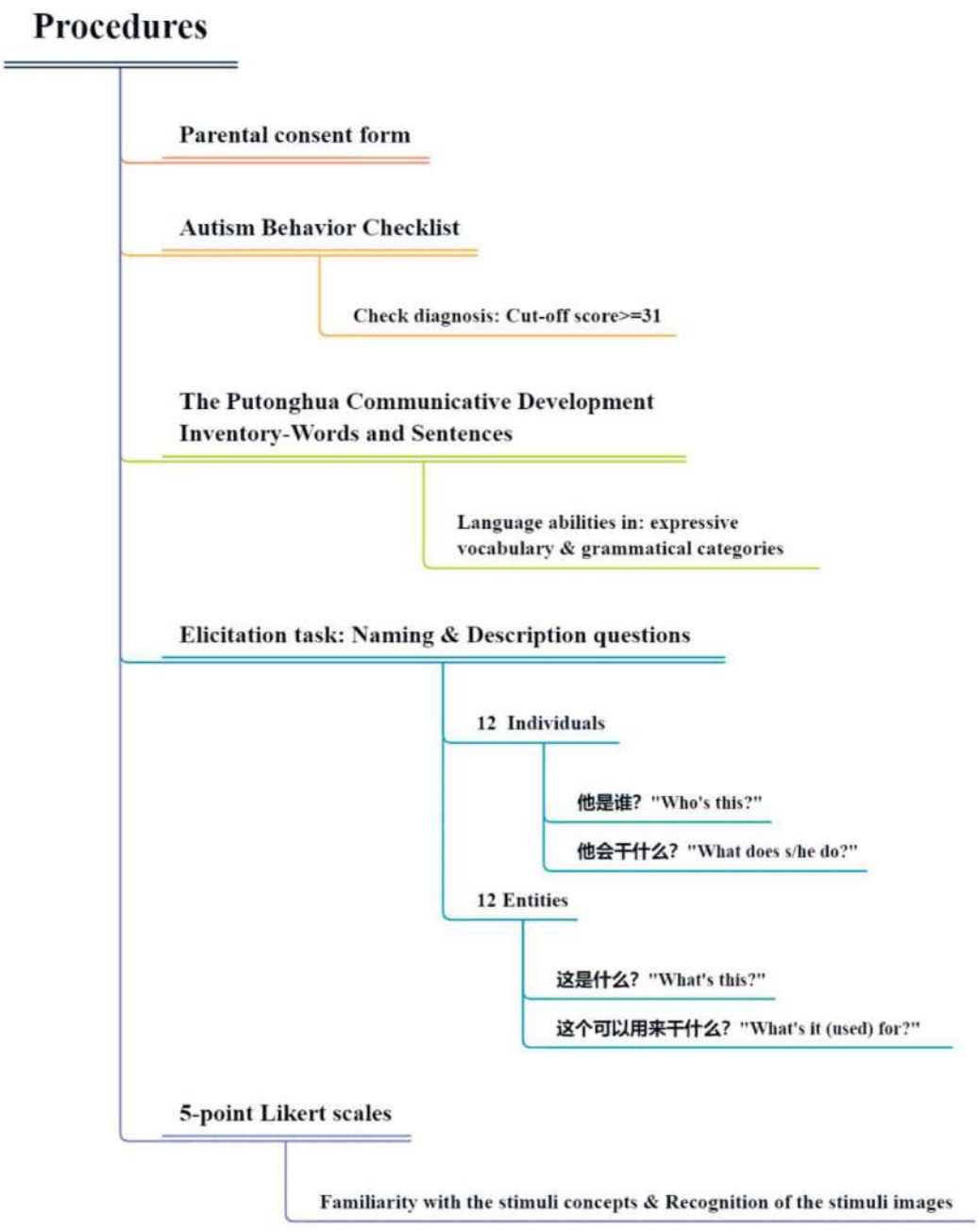

Figure 4.1 Flow-chat on the procedures of this research

4.3 Results

In order to answer the research questions on the types and functions of echolalia in this study, the results are analyzed from two perspectives: the qualitative analysis of the functional complexity of echolalic utterances, and the quantitative results of the types of echolalia produced by the children with ASD. The first subsection shows the qualitative language data, analyzing the complex functional usages of echolalia used by the children with ASD in prototypical examples. The specific functions can be concluded as: (a) question-oriented functional echolalia (i.e., naming, description, topic development); (b) conversation or self-oriented functional echolalia (i.e., conversation maintenance strategy and cognitive strategy); and (c) semi-functional or non-functional echolalia. The second subsection presents the quantitative analysis, including (a) the amount and percentages of echolalia vs. common nouns and statements; (b) the amount and percentages of functional, semi-functional, and non-functional echolalia; and (c) echolalia varies in time span, creativity, and sources.

4.3.1 Qualitative analysis of the functions of echolalia

This data encompasses numerous instances of delayed functional echolalia used to answer the experimenter's questions (i.e., 'Question oriented'). The primary forms of such functional echolalia are: 1) conventional linguistic units (i.e., socio-communicative formulae and socio-cultural emblems, see Dornelas & Pascual 2016 and Pascual et al. 2017); 2) specific prior enunciations (i.e., lines from songs or movies,

or the child's own life); and 3) onomatopoeia (e.g., imitations of an object's sound).[2] The main functions of fixed verbal formulae used as question-oriented echolalia are: 1) naming (e.g., 生日快乐！"Happy birthday!" to name the birthday cake); 2) description (e.g., 睡觉, "Go to sleep" to describe the function of a bed); and 3) topic development (e.g., 比赛开始，比赛！"The competition begins, let's compete!" to expand on the child's prior answers on a car's name and function).

Second, the data also shows some instances of immediate functional echolalia, in which the child repeats the experimenter's question in the preceding turn. These seem to be used as: 1) a conversation management strategy, i.e., 'conversation oriented', the experimenter's question being repeated to show conversation engagement (e.g., 他是谁？"Who's this?" – 他是谁？"*Who's this?*"); or as 2) cognitive strategy, i.e., 'self-oriented', an immediate repetition produced when searching for the correct answer (e.g., 他是谁？"Who's this?" –他是谁，他是厨师。"*Who's this? This is a chef.*").

This section discusses specific echolalic occurrences in the data, divided into: (a) delayed functional echolalia used to answer questions; (b) immediate functional echolalia used as conversation management or cognitive strategy; (c) semi-functional echolalia, used as free associations, as well as non-functional echolalia, when no relation is found between the echoed utterance and the target image.

[2] This study follows Pascual et al. (2017), and Dornelas (2018) in including onomatopoeia, as it constitutes a repetition of a previously heard sound. The conventional instances of onomatopoeic words are not coded (e.g., for animals), since I'm solely interested in echoes. Examples of onomatopoeia coded as echolalic are the imitation of a car's whistling sound (嘟嘟巴巴 *Du du ba ba*, Child 2, Resp. 4), a mobile phone's incoming call (叮叮叮 *Ding ding ding*, Child 6, Resp. 22), or the waiting ring (嘟嘟嘟, "Beep beep beep", Child 2, Resp. 22).

(a) Delayed functional echolalia: Question oriented

As expected, the participants in this study relied on delayed echolalia to answer the experimenter's questions in the elicitation task. Consider first this response on the image for 'toilet' (echoed utterances in examples are underlined):

(1) Child 5, Resp. 18: Toilet

EXPERIMENTER: 这是什么？
zhe shi shen me?
What's this?
CHILD: 上厕所。
shang ce suo.
Go to the restroom/Go pee or poop.

In (1), the child does not provide the name of the image asked about. Instead, he produces the commonly recognized Chinese verbal expression that young children and caregivers usually use to indicate the need to relieve oneself. Interestingly, even if the child knew the correct name, which if provided alone would have constituted the target answer to the question, he instead produced the echoed formula including this noun. This seems to show that the name might be stored in memory in isolation, and be more easily retrievable as part of a whole linguistic unit, i.e., a verbal formula associated with a speech act related to the referent. A similar example is:

(2) Child 3, Resp. 1: Mobile phone

EXPERIMENTER: 这是什么？
zhe shi shen me?
What's this?
CHILD: **给妈妈打电话。**
gei mama da dian hua.
Make a call to Mommy.

Here, the child uses a conventionalized and widely recognized verbal expression for making a phone call to name a mobile phone. Together with this socio-communicative formula, echoed from conversations (over)heard repeatedly in his daily life, the child adds information on the specific person to be called. This echolalic utterance is also used to name the target image by Child 5 (Resp. 22) and is freely associated with the phone by Child 7 and Child 8. It is used for topic development by Child 1 after providing the correct name for 'mobile phone', also as mitigated echolalia, adding variations in the person to be called (打电话给爸爸, "Make a call to Daddy", Resp. 7).

The second function of question-oriented echolalia in the language data is 'description', which occurs as an answer to the second question in the elicitation task. Consider first:

(3) Child 6, Resp.7: Telephone

EXPERIMENTER: 这个可以用来干什么?
zhe ge ke yi yong lai gan shen me?
What's it used for?
CHILD: 喂，你好？
wei, ni hao?
Hello, how are you? [Iconic gesture]
CHILD: 打电话。
da dian hua.
Make a call.

Before Child 6 produces two echolalic utterances to describe the function of a telephone, the child had provided the correct noun as a response to the naming question. For the description question, the child first puts two fingers in the shape of a telephone, then he places the imaginary phone close to his ear, with his head inclined to one side, gesturing as though he were answering an actual phone call. At the same time, the child reenacts how people answer a phone call with a fixed socio-communicative expression with a rising intonation 喂，你好？*wei, ni hao?* a polite greeting Chinese speakers commonly use when picking up the phone call. The Chinese 喂？*wei?* is similar to the French and Portuguese "Alô?", which also used by Brazilian ASD children as a means of naming or referring to a phone (cf. Dornelas & Pascual 2016, Pascual et al, 2017; Dornelas 2018). After the mimic performance of answering a phone call, the child utters another widely used fixed expression, i.e., 打电话, "Make a call", as the right answer to the question on the phone's function. These two responses constitute widely recognized formulae that are known by the whole speech community in China in order to describe the function of a telephone, echoing the child's prior experiences with the social scenario of others receiving a phone call.

A similar strategy is illustrated in:

(4) Child 1, Resp. 23: Firefighter

EXPERIMENTER: 他会干什么？
ta hui gan shen me?
What does he do?

CHILD: 宝宝，那是我的宝宝，那是我的宝宝！那是我的哥哥。喷水，喷水！发射，把火泼灭！
bao bao, na shi wo de bao bao, na shi wo de bao bao! na shi wo de ge ge. pen shui, pen shui! fa shei, ba huo po mie!
Baby, that's my baby, that's my baby! [Pause-2 secs]
That's my older brother. [Pause-5 secs]
Spray water, spray water! Shooting, (let's) put out the fire!

Here the child theatrically reenacts a dramatic firefighting scene, using different voices. According to his mother, the child repeats part of the cries from a firefighter cartoon movie. The first two interjections are ascribed to two eyewitnesses: the parent and the younger sibling of two fire victims. The child then shifts perspective to the rescuer, shouting the standard fixed expression Chinese firefighters typically use when calling for rapid, joint action in putting off a fire (喷水… "Spray water…!"). These utterances serve to describe the firefighter's job by lively demonstrating the different vocal registers of victims and first-responders.

During the task, the participants also echoed speech to expand on the topic of the ongoing conversation. These cases of topic development follow the correct naming or description of the functions of the objects or professions of individuals, further describing them vividly, often with an animated tone, iconic gestures, or facial expressions. Such expansions are always related to the children's direct experience of

using the target entities or interacting with the target professionals or individuals, as confirmed by the children's parents. Consider first:

(5) Child 1, Resp. 4: Chef

EXPERIMENTER: 他会干什么？
ta hui gan shen me?
What does he do?

CHILD: 蔬菜，面包。他会煮一下，菜。汉堡，做好咯！
shu cai, mian bao. ta hui zhu yi xia, cai. han bao, zuo hao luo!
Vegetables, bread. He can cook, [Pause: 14 secs] vegetables. [Pause: 9 secs] [Iconic gesture]
The hamburger, [Pause: 2 secs] is ready!' [Iconic gesture]

In (5), the child first answers the question on what a chef does by providing two types of food typically prepared by such professionals. He subsequently gives a descriptive statement on chefs being able to cook vegetables, simultaneously making iconic cooking gestures. The child then takes the chef's voice to say something like "Order up!", indicating that a hamburger is ready for consumption, with both hands up in the iconic gesture of delivering food to customers. This can be regarded as an expansion on the topic of what a chef masters, further illustrating this profession. According to the child's mother, he echoes the exact words related to a chef that he heard from a televised cartoon series. The child associates the chef with the socio-communicative formula that is part of the overall social situation represented in a restaurant scene in the original cartoon.

A similar example is:

(6) Child 6, Resp. 10: Policeman

[Responding before question]
CHILD: 保安叔叔，抓住别人的。别跑，把你抓走！
bao an shu shu, zhua zhu bie ren de. bie pao, ba ni zhua zou!
Security uncle [agent], catches someone. [Pause: 4 secs]
Don't run, (I'll) take you away!

Here, the child directly names the profession presented, mistaking the policeman by a community security agent, a very common figure in Chinese city residential neighborhoods. After naming what he sees in the picture, the child utters a descriptive statement on what the police does, namely arrest people. Then, after a pause, he expands on it by taking the voice of a policeman addressing a suspect. This occurs before any questions were asked, suggesting that the child anticipates the experimenter's questions and interiorizes their order ("Who's this?" and "What does s/he do?"). This interpretation is plausible, since this is the tenth target image and appearing after he provides the correct answers to the anticipated test questions for images 4, 6, and 8. After responding to the anticipated questions, the child develops the topic by reenacting verbatim an enunciation from a cartoon on police agents that he loves, according to the child's mother.

The above examples involving the echolalic occurrences produced by children with ASD are mainly used to answer the questions to complete the communication task. In conclusion, the specific functions of echolalic utterances used by children with ASD to reach the interactional goals in conversation are: naming, description, and topic development.

(b) Immediate functional echolalia: Conversation oriented and self-oriented

Except for two children, i.e., Child 1 and Child 4, all other participants occasionally repeated (part of) the experimenter's question in the preceding turn. Immediate echolalia seems invariably used either to show engagement or to manage their own thought processes. Consider first this piece of dialogue:

(7) Child 3, Resp. 13: Teacher

EXPERIMENTER: 他是谁？
ta shi shei?
Who's this?
CHILD: 他是谁？
ta shi shei?
Who's this?'
EXPERIMENTER: 他会干什么？
ta hui gan shen me?
What does she do?
CHILD: 他是谁？
ta shi shei?
Who's this?'

Here, the child repeats exactly what the experimenter had just asked, echoing this first question again after the second question. The child does not provide an answer to either question, while looking committed to the task. However, the multimodal cues suggest a different picture. His steady gaze on the test image shows full focus, his calm facial expression indicating that he does not repeat the experimenter's words out of impatience or annoyance. Instead, the child seems to indicate his wishes to keep the conversation going. The child repeats the immediately preceding test questions with a similar focused and calm demeanor (e.g., responses 11, 14, 22, and 23), until managing

to provide the right answers for some other stimuli. This further shows the child's engagement in the conversation. A similar example from a different child is:

(8) Child 8, Resp. 21: Baby bottle

EXPERIMENTER: 这是什么？
zhe shi shen me?
What's this?
CHILD: 奶瓶是用来拿调羹泡奶。
nai ping shi yong lai na tiao geng pao nai.
The nursing bottle is used to take a spoon to make milk.
EXPERIMENTER: 这个可以用来干什么？
zhe ge ke yi yong lai gan shen me?
What's it used for?
CHILD: 这个可以用来干什么？
zhe ge ke yi yong lai gan shen me?
What's it used for?
EXPERIMENTER: 你告诉老师，这个可以用来干什么？
ni gao su lao shi, zhe ge ke yi yong lai gan shen me?
Please tell the teacher [me], What's it used for?'
CHILD: 老师，这个可以用来干什么？
lao shi, zhe ge ke yi yong lai gan shen me?
Miss, what's it used for?'

In (8), when asked what baby bottles are for, the child repeats the experimenter's question verbatim. This question is then asked once more, and the child repeats the exact question right after again, never providing the right answer. The child may have been puzzled by being asked questions, since he had already provided the proper function of the baby bottle in the naming question ("The nursing bottle is used to take a spoon to make milk"). Thus, his twice repetitions of the question are to express his wish to manage the ongoing conversation and then move on to the next target image.

The other function of immediate echolalia in the dataset is that of cognitive strategy, in which the experimenter's prior question is repeated as a form of self-talk. Take first:

(9) Child 2, Resp. 7: Fruit Seller

[Responding before question]
CHILD: 这（是）什么？不知道。
zhe (shi) shen me? bu zhi dao.
What('s) this? (I) don't know.
EXPERIMENTER: 他是谁？
ta shi shei?
Who's this?
CHILD: 这是老妖婆。
zhe shi lao yao po.
This is an old witch-lady.
EXPERIMENTER: 她会干什么？
ta hui gan shen me?
What does she do?
CHILD: 是奶奶。她是买水果。
shi nai nai. ta shi mai shui guo.
Is grandmother. She is *[we'll now go]* buy fruits.

Upon seeing the image of the fruit seller, the child first anticipates the experimenter's question and echoes it, then proceeding to answer it himself. After this two-turn private dialogue with himself, and after the experimenter's actual question, the child first answers with a delayed echoed phrase from a television cartoon series ("an old witch-lady"), which according to the child's mother is how he uses inappropriate references to elderly women. Subsequently, after the second question on the woman's profession, the child produces a declarative, polite way to refer to an elderly woman in Chinese instead ("Is grandmother"). When the experimenter asks the second question again, the child does not provide the right profession through an echolalic enunciation that

translates as “She is *[we’ll now go]* buy fruits”. The child’s initial inner question-answer pair thus seems to have helped him to produce acceptable answers to both questions in later turns.

The following small dialogue further illustrates the use of immediate echolalia as cognitive strategy:

(10) Child 8, Resp. 10: Policeman

EXPERIMENTER: 他是谁？
ta shi shei?
Who’s this?
CHILD: 老师，他是谁？
lao shi, ta shi shei?
Miss, who’s this?’
EXPERIMENTER: 他是谁？
ta shi shei?
Who’s this?
CHILD: 他是警察。他是警察抓小偷。
ta shi jing cha. ta shi jing cha zhua xiao tou. […]
He’s a policeman. He’s a policeman catching a thief. […]
EXPERIMENTER: 他会干什么？
ta hui gan shen me?
What does he do?
CHILD: 他会干什么呢？
ta hui gan shen me ne?
What does he do?
EXPERIMENTER: 他会？
ta hui…?
He can [is able to] …?’
CHILD: 他会抓坏人。
ta hui zhua huai ren. […]
He can [is able to] catch bad guys. […]

Here, the child first repeats the experimenter’s immediately preceding question, using a Mandarin respectful vocative to address the experimenter. He is then asked to name

the target image again, and this time the child provides the right answer, also giving information on the policeman's profession. Regarding the second question, the child repeats exactly what the experimenter had just asked, the experimenter then asking it again as a leading question. This time the child quickly provides the correct answer on what a policeman does.

The repetitions of the test questions in (10) are typical instances of echolalia used as cognitive strategy. This is a common occurrence in the data, the right answer following a repetition of the prior question when coded as cognitive strategy. In all such cases, the child is calm and speaks in a flat tone, seemingly trying to organize his own thoughts, thus using self-talk for lexical retrieval.

Both delayed and immediate echolalia are primarily used functionally by children with ASD in this study, as concluded in above examples, the specific functions thus are: naming, description, topic development, conversation management strategy, and cognitive strategy. However, there are also a few instances are semi-functional and non-functional echolalia.

(c) Semi-functional and non-functional echolalia

All occurrences of semi-functional and non-functional echolalia in the data are of delayed echolalia. The degree of functionality is determined on the basis of multi-modal cues, and I also asked the parent or therapist for their interpretation of occurrences when needed. Semi-functional echolalic utterances are liminal cases of free association, mainly produced before the experimenter's first question during the

first seconds after the child was presented with an image for the first time. Consider first:

(11) Child 7, Resp. 5: Delivery man

[Responding before question]
CHILD: 包裹。
bao guo.
Parcels.
CHILD: 你的包裹。
ni de bao guo.
(Here are) your parcels.

Upon seeing the image of the delivery man carrying a package, the child utters the Mandarin word for 'parcels' by focusing on the part of the stimuli image. Immediately after that, the child produces a declarative echolalic utterance ascribed to the delivery man, which is commonly used by delivery agents handing packages to customers. The child's father explains that the child is familiar with the scene of picking up mail deliveries, and that in (11) he is clearly echoing the standard Mandarin formula commonly used by delivery agents when handing packages to customers. This socio-communicative formula is not used to answer any question, but is instead freely associated with the target image and thus coded as semi-functional.

Consider a similar example of semi-functional echolalia:

(12) Child 4, Resp. 9: Peppa Pig

[Responding before question]

CHILD 佩奇是大的，佩奇是小的。
Pei qi shi da de, pei qi shi xiao de.
Peppa is big, Peppa is small.

EXPERIMENTER: 她是谁？
ta shi shei?
Who's this?

CHILD: 她是佩奇。
ta shi pei qi.
This is Peppa.

Upon seeing the image of the cartoon character Peppa Pig, the child produces what needs to be understood as a form of mitigated echolalia. According to the child's mother, the bit on big and small is echoed from the child's experience at the therapy center, when learning to distinguish sizes and practicing the Mandarin Chinese words for 'big' and 'small'. Note that these two words are integrated into the larger construction 'X is big, Y is small', filled with the subject 'Peppa', the target image. Hence, the child seems to have produced this mitigated echolalic utterance as a verbal outburst, as a free association that in fact includes the correct name of the image presented.

Lastly, two echolalic utterances in the data seem to be used non-functionally, after lengthy discussions with the parents and therapists. These are echoed enunciations that fail to answer the questions posed and neither seem to function to manage the conversation nor help the children think. The first example is:

(13) Child 3, Resp. 6: Money bill

[Responding before question]
CHILD: 妈妈做饭。
mama zuo fan.
Mommy cooks.
EXPERIMENTER: 这个可以用来干什么?
zhe ge ke yi yong lai gan shen me?
What's it used for?
CHILD: 妈妈做饭。
mama zuo fan.
Mommy cooks.

In (13), upon seeing the image of the money bill, the child produces a declarative enunciation on his mother cooking that he had previously heard repeatedly, according to his mother. When asked about the function of the money bill, he repeats that echoed utterance again, failing to answer the question. This echoed expression seems semantically irrelevant to the task, as not even the child's mother could relate the child's experiences with money with her cooking or the original source of that repetition. Also, the child does not seem to use it to manage the conversation (e.g., express a wish to shift the topic to discuss something related to his mother and/or cooking) or manage his own thoughts (as a means of support towards answering the question). This child also produces this echoed enunciation upon seeing the image of the fruit seller (Resp. 9), for which the coders and the mother also saw no connection. Of course, one needs money to buy food that one can then cook, so the relation between cooking and the money bill and the fruit seller is closer than if the echoed utterance on cooking had been produced upon seeing the toilet or bed images, for instance. However, the child's mother is quite certain that this utterance is purely parroted from the child's

earlier verbal experiences. He heard so from his grandmother when he asked where's mom, so he frequently repeats it in inappropriate contexts in everyday life, making it a candidate for a verbal tic as opposed to a functional echolalic occurrence.

A similar example by a different child is:

(14) Child 3, Resp. 5: Bed

[Responding before question]
CHILD: 妹妹喜欢袋鼠
mei mei xi huan dai shu.
Younger sister loves kangaroos.
EXPERIMENTER: 这是什么？
zhe shi shen me?
What's this?
CHILD: 床上
chuang shang.
On the bed.

Here, the child repeats a line from a cartoon movie, according to his mother. The mother could find no connection between the original utterance and the child's experience with beds or sleeping. Therefore, this instance is classified as non-functional echolalia. The child's later turn shows that he does understand that the target image represents a bed.

There are also ambiguous cases of delayed echolalia in the dataset. An example is a pure echolalic utterance translated as "Smelly. Flushing water, flushing" (Child 7, Resp. 18), produced before the experimenter's first question on the toilet, after naming the object twice and providing its function three times. In that context, this could equally be interpreted as topic development (i.e., functional echolalia) or free

association (i.e., semi-functional echolalia). Without further evidence, it seems the most appropriate designation.

In sum, this section analyzed some prototypical examples showing different levels of function in echolalic utterances produced by children with ASD, including functional echolalia (i.e., Question-oriented: naming, description, topic development; Conversation-oriented: conversation management strategy, cognitive strategy), semi-functional echolalia (i.e., free associations), echolalia with ambiguous functions, and non-functional echolalia (i.e., meaningless repetitions).

4.3.2 Quantitative results of the forms and types of echolalia

The children with ASD in this study all produced a relatively high proportion of echoed speech. Critically, 120 out of the 196 echolalic instances uttered during the task were unequivocally functional. Most such cases were used to answer the experimenter's question, while other few occurrences were used to manage the ongoing interaction or the child's own mental process. This also included 58 cases of free associations, constituting semi-functional echolalia, 2 echoed utterances used for no apparent function, and 14 ambiguous cases, as shown in the qualitative results above.

As for the creativity level of all echoed occurrences irrespective of their functionality, most of them were instances of pure echolalia, only a few instantiating mitigated echolalia. Regarding the span of time between the repetition and the original utterance being echoed, there found a high proportion of delayed echolalia, immediate echolalia making up a very low proportion. As one should expect given the study's

eliciting nature, the highest proportion of these original echoed sources were standard formulaic expressions widely recognizable by most or all members of the linguistic community (i.e., socio-communicative formulae and socio-cultural emblems). They were followed by specific prior interactions from the children's lives only recognized by their close circle, with echoed sources recognizable by a specific group in the community (from cartoon movies, television programs, and storybooks), making the lowest proportion.

In what follows, I present the distribution of: (a) echolalia vis-à-vis referential and descriptive alternatives; (b) functional, semi-functional, and non-functional echolalia; and (c) delayed vs. immediate, and pure vs. mitigated echolalia, as well as echolalia from different sources.

(a) The production of echolalia vs. common nouns and statements

In terms of form, the children's responses were divided into three main categories: echolalia, common nouns, and statements (i.e., creative declarative expressions). The children's responses to the first question (i.e., "What's/Who's this?") were, not surprisingly, mainly either echoed utterances or common nouns, whereas the answers to the second question (i.e., "What's it used for?" or "What does s/he do?"), mainly consisted of either echoed utterances or creative statements. The proportions for the eight participants are presented in **Table 4.6**, which encompass all forms and functions (incl. semi-functional and non-functional echolalia).

As **Table 4.6** presents, participants produced more conventional nouns (almost

50%) than any other category. However, when compared with the categories of 'Statements' and 'Other', there was a high proportion of echolalia. The production of verbal formulae being even higher than that of statements (an average of ~26% vs. ~17%). Specifically, echolalia included verbal formulae (e.g., "Happy birthday!") and onomatopoeic occurrences (e.g., "Beep beep"). Common nouns included concrete common nouns (e.g., "Teacher") and family class nouns for politeness (e.g., "Uncle", "Grandmother", see examples 6 and 9 in the above section). 'Statements' comprise creative non-echoed descriptions of the function or profession depicted therein (e.g., "Used for singing" for 'microphone', as an answer to the question "What is it used for?").

Table 4.6 Main formal categories

FORMS	**Common Nouns**		**Echolalia**		**Statements**	**Other**	**Total**
	Concrete common nouns	*Class nouns (generic)*	*Verbal formulae*	*Onoma topoeia*			
Amount	313	62	193	3	131	56	758
Percentage	41.29%	8.18%	25.46%	0.40%	**17.28%**	**7.39%**	**100%**
	49.47%		**25.86%**				

A few responses could not be categorized as valid –or even interpretable– and were thus excluded from analysis (see **Table 4.7**). The first type of such 'Other' occurrences was 'verbal tics', automatic word strings that were not echoed from a fixed expression or a specific prior enunciation. An example is 他会说话, "He can talk", produced by Child 1 after being asked what a given professional does in as many as twelve of his responses. The child's mother confirmed that this was not a repetition from the child's

life, and it is not a standard fixed expression in Mandarin Chinese either. Other sub-types in the 'Other' category were iconic gestures and creative enactments, namely full one-time theatrical demonstrations produced on the spot, which were thus not echoed. Unrelated or meaningless responses were neither echolalic nor related to the task, and ambiguous cases were those hard to categorize. Lastly, unintelligible responses mostly consisted of mutterings that not even the children's parents could interpret.

Table 4.7 'Other' category

Categories	**Verbal tics**	**Iconic gestures**	**Creative enactments**	**Unrelated or meaningless**	**Ambiguous**	**Un--intelligible**	**Total**
Amount	10	8	1	19	9	9	56
Percentage	1.32%	1.05%	0.13%	2.51%	1.19%	1.19%	**7.39%**

The distribution of the main categories and the 'Other' category is presented more clearly in the following pie chart (see **Figure 4.2**), which displays the percentages of each category in the production of children with ASD in this study.

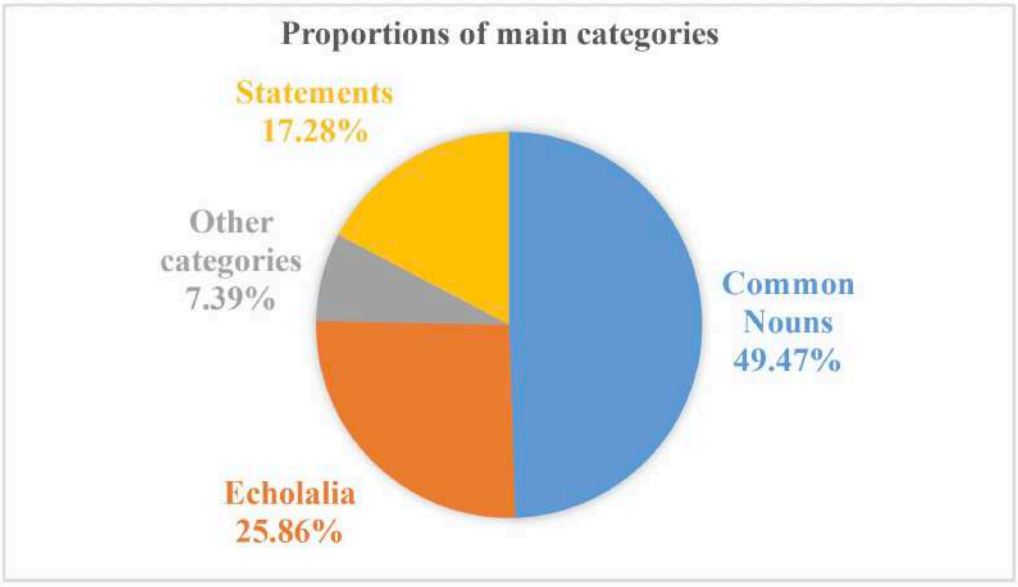

Figure 4.2 Average distribution of the main formal categories

In sum, most occurrences in the data were intelligible, although only one constituted a creative enactment, indicating that the participants' speech was comprehensible but formulaic. It is worth noting that some instances like the ones categorized as 'verbal tics' or 'ambiguous' might have been coded as non-functional delayed echolalia by other research protocols without parental or therapist debriefings.

(b) Functional, semi-functional, and non-functional echolalia

In contrast to the common opinion that echoing may be meaningless and hinder functional language use, the results suggest that echolalia is mostly discernibly functional (~61%). Semi-functional echolalia, which solely involved freely associated verbal formulae and is thus not entirely meaningless or communicatively useless, also makes up a relatively high proportion (~30%). Non-functional echolalia constituted by far the smallest proportion of echoed occurrences (~2%). It might be tempting to regard

these instances of non-functional echolalia as illustrative of the entire phenomenon, as they stand out from the flow of conversation, but the data suggest the opposite. It must be clarified, however, that this is partly a result of the task's design. Non-functional echolalia may be more frequent in a naturalistic setting when the child is distracted, tired, bored, or distressed. In some cases, it is not possible to determine the specific function of indisputably echoed utterances, even after discussing them at length with the child's parent (see **Table 4.8**).[3]

Table 4.8 Functional, Semi-functional, and Non-functional echolalia

Categories	**Functional echolalia**			**Semi-functional echolalia**	**Non-functional echolalia**	**Ambiguous**	**Total**
	Question oriented	*Conversation oriented*	*Self-oriented*	*Free association*	*Meaningless repetition*		
Amount	92	9	19	58	4	14	196
Percentage	46.94%	4.59% **61.22%**	9.69%	**29.60%**	**2.04%**	**7.14%**	**100%**

Critically, question-oriented functional echolalia encompassed the largest portion, with nearly half of all echolalic utterances (~47%). They were thus mainly used to name the target entity or profession (responses to question "What's this? / Who is s/he?"), to describe it (responses to question "What's t used for? / What does s/he do?"), or to expand on a previously introduced topic (developments on prior responses to either

[3] The calculation includes each individual echolalic occurrence rather than only different echoed utterances. For instance, only two echoed utterances were used non-functionally in the data (one on a mother cooking and one on kangaroos), but since the former was uttered twice in example (13) and once related to the fruit seller, four occurrences of non-functional echolalia were counted in total.

question or both). Some echoed occurrences also seemed to function as communicative strategy to manage the conversation (~5%) or as cognitive strategy to help children think (~10%). **Figure 4.3** presents the distribution of fully functional echolalia.

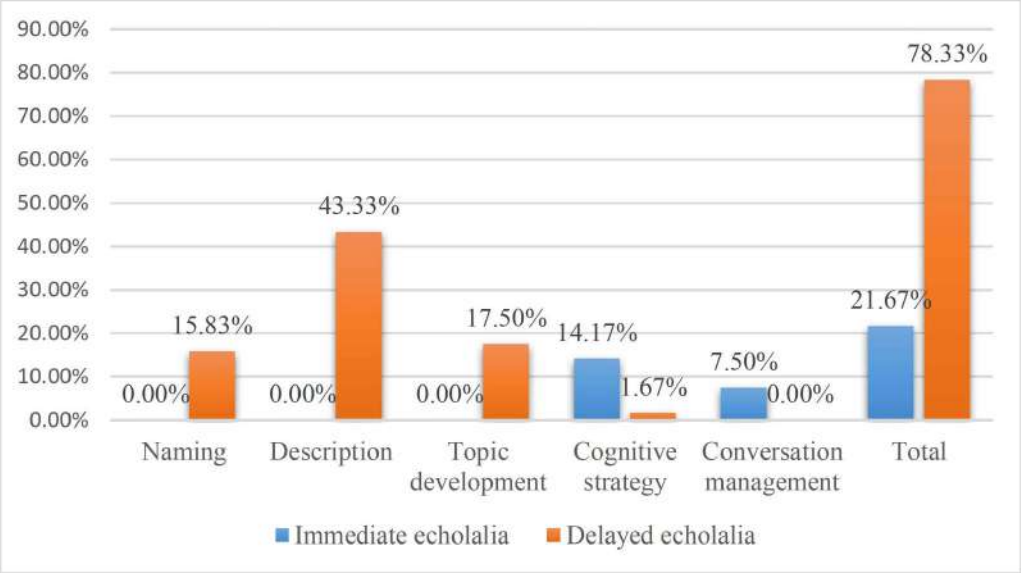

Figure 4.3 Specific functions of functional echolalia

All question-oriented functions constituted cases of delayed echolalia. Most of these served as descriptions of the professions or the functions of entities. The rest were used to name or expand on an earlier introduced topic. By contrast, all occurrences used as conversational maintenance strategy were of immediate echolalia, while only a small proportion of echolalic utterances were used to hold the floor. Furthermore, all but two occurrences of echolalia used as cognitive strategy consisted of immediate echolalia.

Among these five specific functions, the descriptive function was the most frequently occurring one, making up almost three times the amount of functional echolalia for naming (~43% vs. ~16%, see **Figure 4.3**). The description question

eliciting more functional echolalia than the naming question may indicate that it is harder for children with ASD to produce an entire statement than a common noun. The topic development function was moderately represented, making up a slightly higher proportion than that of naming (~18% vs. ~16%). This is remarkable, relatively small as these proportions and the difference between them are, since this study was not a naturalistic study or one where children were encouraged to talk about their experiences with the referents in the stimuli. Different from the case for naming, however, participants with a more fluent vocabulary (Child 1, 5, 6, 7, and 8) used more echoed verbal formulae as topic development and description.

The function of cognitive strategy is the only one that was attained through both immediate and delayed echolalia, even if these were overwhelmingly echoes of the experimenter's immediately preceding turn. In two cases, these were delayed mitigated repetitions of the task's previously heard questions before any question on the new image was asked, in which the child integrated the name of the target image (e.g., 医生做什么的？"What does a doctor do?", Child 7, Resp. 16; 话筒怎么用的？"How's the microphone used?", Child 7, Resp. 17). Lastly, the function of communication maintenance strategy constitutes the smallest category, most probably reflecting the nature of the task, with its simple, fixed, and repetitive structure, thereby not inviting conversation shifts.

(c) Echolalia varies in time span, creativity, and source

In this section, I discuss: 1) the time span between echoed occurrences and the original utterances (delayed vs. immediate echolalia); 2) the creativity level of echoed instances (pure vs. mitigated echolalia); and 3) the different sources of echolalia (widely recognizable by the entire linguistic community, by a specific social group, or only by the child's close circle).

The majority of echolalic utterances produced by children with ASD in this study are delayed ones (see **Figure 4.4**). The main reason is the elicitation task with only open questions to be answered was designed, which prompted the participants to produce new speech grafting onto old speech. But still, children with ASD uttered a small proportion of immediate echolalia, mostly are the repetitions of test questions, as exemplified in the above section when analyzing the functions of conversation management strategy and cognitive strategy.

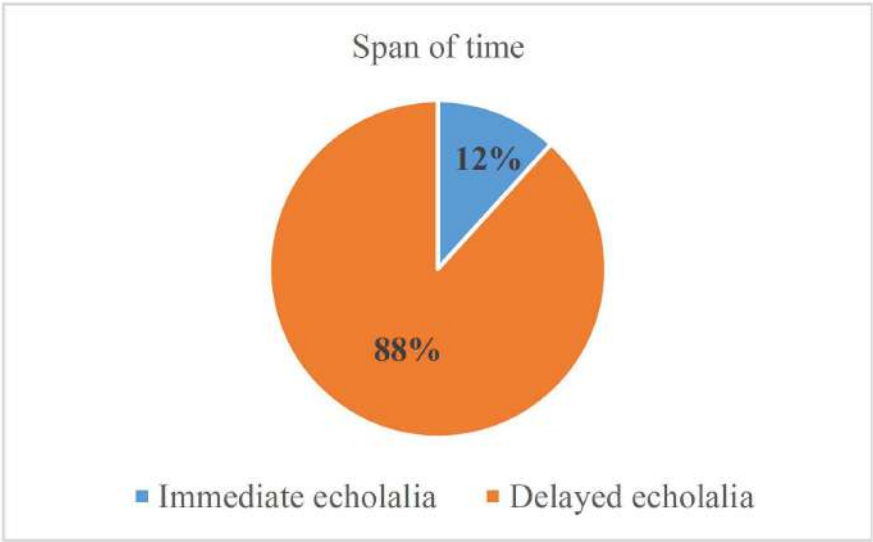

Figure 4.4 Distribution of immediate vs. delayed echolalia

The different proportion of delayed and immediate echolalia in the data may reflect the interest in the functionality of delayed echolalia, which has received little attention in the literature and which seems to have far-reaching theoretical implications. Regarding the level of creativity, the data showed three times more instances of pure echolalia than of mitigated echolalia (see **Figure 4.5**).

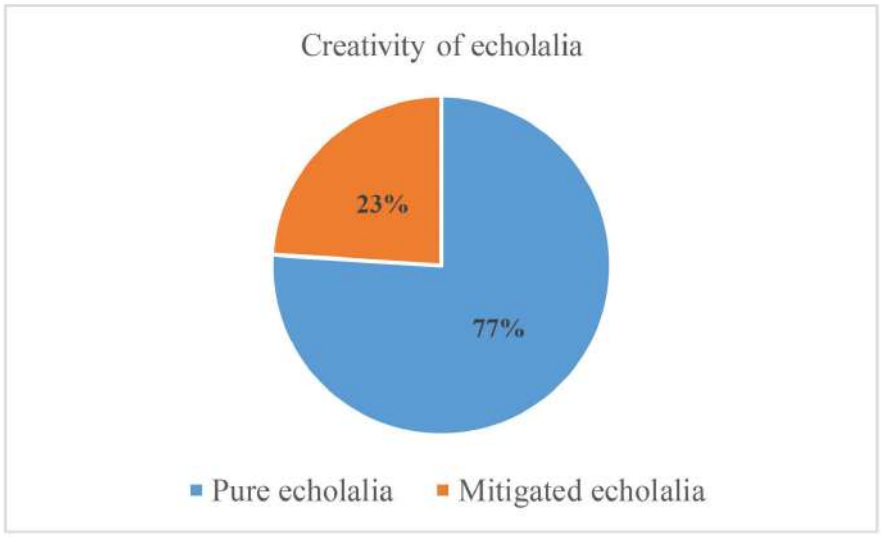

Figure 4.5 Distribution of pure vs. mitigated echolalia

A greater production of pure than mitigated echolalia means that these echoed expressions were entrenched as fixed units of socio-communicative formulae or socio-cultural emblems. Such expressions might be similarly stored as cultural idioms or formulaic sequences. By contrast, there was more mitigated echolalia in specific prior utterances from the child's own life.

As for the sources of echolalia, most were fixed expressions recognizable by most or all members of the linguistic community (see **Figure 4.6**). Specifically, 63% of echolalic occurrences constituted fixed socio-communicative formulae (e.g., 喝点水,

"Have some water!" for 'glass') or socio-cultural emblems (e.g., 生日快乐！ "Happy birthday!" for 'birthday cake'). While the study was designed to elicit easy-to-identify echolalic utterances, 35% of delayed echolalia was specific to a child's prior verbal experiences. An example is an utterance that translates as "Her leg was broken, and she stays at the hospital", produced upon seeing the image of the bed (Child 6, Resp. 14). According to the mother, this was a repetition of her own prior speech, from when a friend of hers broke a leg, and the mother told the child why they were going to visit that friend in the hospital. Lastly, only 2% of echoed occurrences in the data originated in lines from storybooks or cartoon movies (e.g., from *Peppa Pig* and the Ryder character from the *PAW Patrol*), which are recognizable by a specific group in the linguistic community.

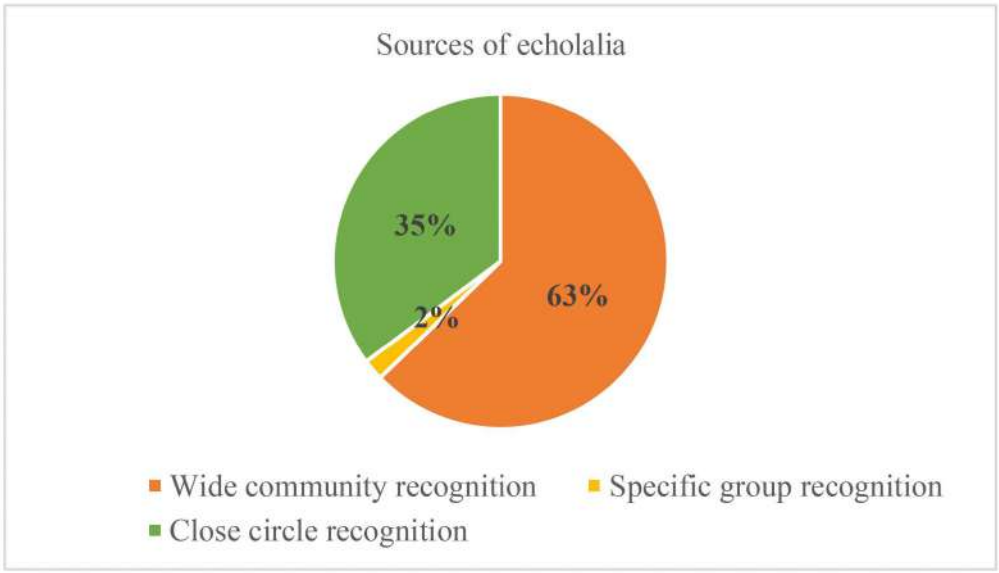

Figure 4.6 Distribution of sources of echolalia

These results on the sources of echolalia should be interpreted as partly reflecting this study's goal of exploring fixed expressions and individual occurrences shared by a large number of speakers in the linguistic community. Thus, the stimuli were all either commonly associated with given standard verbal formulae or with specific prior interactions from popular cartoons. Indeed, in admittedly as small a database, a prior naturalistic study found more examples of echolalic specific prior enunciations than standard socio-communicative or socio-cultural formulae (Dornelas & Pascual 2016, Pascual et al. 2017).

In the data, echolalia made up a relatively high proportion, demonstrating that it plays an important role in autism speech. The participants seemed to produce echolalia when failing to retrieve a corresponding noun or generate a creative statement. The cognitive load involved in storing ready-made linguistic units in long-term memory may be much lighter. Hence, functional echolalia may not simply be stereotyped, it may be used as a coping strategy in language pathology.

4.4 Discussion

This section presents remarkable language phenomena based on the examples discussed above, including quoted fictive speech as echolalia from the theory of fictive interaction, echolalia involving perspective shifting from a social-emotional salience approach, and target nouns embedded in echolalic utterances. As a whole, this study reveals the great importance and functionality of echolalia in autism speech.

4.4.1 Verbatim fictive speech manifested as echolalia

In fictive interaction, the type of fictive speech (manifested as echolalia) that helps structure cognition (i.e., thought) when talking to oneself is observed in the autism language data in this study. For example, the participants produced 想一想 "Think about it" to themselves to allow themselves to think about the answers, which supports the idea that fictive speech may help structure one's thoughts as an inner conversation. The echolalic formulae or the memorized chant were also used metonymically. For example, the participants answered "Happy birthday" or sang a birthday song to refer to the cake when being asked to name a birthday cake. In such cases, the children with ASD made mental contact with the whole birthday scenario in their minds.

The echolalia produced by the participants in this study can be regarded as a type of verbatim fictive speech that is echoed from prior interactional experiences in the children's daily life. The phenomenon of fictive interaction accounts for the 'non-genuine' usages of formulae in conversation to either answer test questions metonymically, help manage the conversation, or help structure inner thought. Such fictive usages of verbatim speech help children with ASD associate prior interactional experiences by using limited language resources, and also help them to communicate in an effective way, as an adaptive strategy (Dornelas & Pascual 2016).

Thus, fictive interaction theory helps understand and account for the echolalic speech produced by children with ASD from the perspective of language and cognition. The fictive usages of echolalia in autism speech support the idea that fictive interaction,

as adaptation strategy, also helps groups with language disorders to communicate, such as those with aphasia or autism.

4.4.2 Social-emotional salience approach: Perspective shifting by using echolalia

The elicited echolalic utterances in the dataset show interesting and unexpected forms that had so far not received much attention in the ASD or linguistics literature. An example is echolalia involving multiple viewpoints shifts in one single conversational turn, as in the firefighter example (4), in which the child enacts two fire witnesses and the firefighter himself. Other children also show the ability to shift perspectives by using verbatim repetitions. Thus, the data show that some children with ASD are good at taking the perspective of others in order to satisfy immediate communicative goals. This is non-trivial, since individuals with ASD are generally reported to have trouble with 'Theory of Mind', i.e., one's ability to recognize and attribute mental states to oneself and others, and to understand that one's feelings and beliefs may be different from others (Wellman & Gelman 1998; Peterson et al. 2005).

Instead, the evidence of perspective shifting in discourse is more consistent with a 'social-emotional salience approach' to autism (Weeks and Hobson 1987; Gaigg 2012), insofar as the perspectives taken by the speaker emerge from learning the emotionally salient responses of specific actors in typical situations.[4] Therefore, this difficulty may only be valid at high cognitive levels, reflecting specific task demands

[4] Thanks to Todd Oakley, who put forward this great idea during our communication on the paper "Functional echolalia in autism speech: Verbal formulae and repeated prior utterances as communicative and cognitive strategies" (in preparation), on which this chapter is based.

rather than a categorical deficit. Thus, autism does not seem to automatically mean an inability to put oneself in others' shoes, at least not regarding vocally stereotyped social situations.

In other cases, the same visual stimulus prompted echoed enunciations ascribed to different conversational participants in the prototypical interaction relative to an elicited semantic frame. For instance, the image of the delivery man led one child to take the voice of the target referent as the speaker (e.g., 你的包裹, "[Here are] your parcels", Child 7, Resp. 5). In contrast, another child enacted the customer receiving the package, the target referent being the addressee (e.g., 谢谢你, "Thank you!", Child 8, Resp. 5). The participants thus managed to identify the entire social-communicative situation prototypically associated with one element in it (e.g., a delivery man). This is striking since children with ASD are well-known for being detailed-oriented and better with grammatical form than with social communication (Tager-Flusberg 1994, 2001; Naigles 2017; Naigles & Tek 2017).

4.4.3 Target nouns embedded in echolalic utterances

Another interesting phenomenon in the data is the appearance of common nouns embedded in echoed occurrences used for naming. For instance, Child 5 answered the question requesting him to name the towel by using the Mandarin Chinese verb-noun structure 擦毛巾 (lit. "Wipe towel", "Wipe [my face with] the towel", Resp. 12), a self-echoed utterance that includes the right name for 'towel'. According to the child's mother, every time the child washes his face, she asks him to wipe it with a towel. Thus,

the image of the towel prompted in the boy this daily washing-up ritual, characterized by an exchange with his mother. Instead of providing the name for 'towel' straightaway, the child repeats this fixed utterance, which includes the name asked about.

Similar examples of free associations were found in the data, which seem to be interpretable as answers to anticipated task questions. Two cases include echoing the statements containing the target common noun as the sentence subject, namely 唱麦克风 ("Sing [with] the microphone"), produced when presented with the image of the microphone (Child 5, Resp. 17), and 警察有枪抓坏人 ("The policeman has guns and catches bad guys"), uttered upon seeing the police officer (Child 8, Resp. 10). Two other instances include echoing the task question with the common noun in the echoed question itself, as in 医生做什么的？ ("What does the doctor do?"), related to the image of the doctor (Child 7, Resp. 16), and 话筒怎么用的？ ("How's the microphone used?"), related to the microphone (Child 7, Resp. 17). This phenomenon has also been identified in spontaneous ASD speech (Dornelas & Pascual 2016: 354; Pascual et al., 2017: 317). Hence, fixed linguistic units are part of the child's stored verbal repertoire that may be used as *pivot schemas* for including the common nouns needed to name the concepts with which they are associated, even though nouns are simpler forms. Far from being an impairment, functional echolalia seems to be a template for in-the-moment communicative creativity.

4.5 Summary

Most echoed occurrences in the dataset are clearly functional. All 8 children with ASD in the pool showed they master echolalia for different communicative goals (i.e., naming, description, topic development, conversational maintenance) or thinking aloud (i.e., cognitive strategy). Even when failing to answer the task's questions in a standard manner, the ultimate meaning and communicative intentions behind their echolalia in that context were still clear in most cases. Hence, children with ASD do seem to be aware of social norms and situations; they can associate socio-communicative formulae and socio-cultural emblems within given socio-cultural frames. Echolalic formulae, therefore, comprise effective strategies and are indicators of linguistic and communicative competence in ASD.

These findings are of theoretical and clinical significance, as they indicate the effective use and importance of echolalia in autism speech. While the presence of echolalia may serve a diagnostic function, it does not so much seem pathological as enabling. Also, functional echolalia, in all forms, not only encompasses immediate echolalia or specific prior interactions from the child's inner circle, which are the types most studied. Instead, prototypical functional echolalia also includes fixed expressions entrenched in the linguistic community, which should thereby receive more attention in autism research. Given the importance and wide functions of fixed linguistic units echoed from the speech of others, such formulaic sequences are manipulated as 'pre-packaged' assemblies. Similar to the role of formulae (dealt with in Chapter 5) in typical language development and ordinary language use (Langacker 1999; Wray &

Perkins 2000), the functions of echolalia in autism speech should also receive more attention in general and applied linguistic theories.

Moreover, the functional use of echolalic self-talk (e.g., example 10) may pave the way for inner speech. Dialogue is a precursor and product, a mediator and tool of self-system functioning. Dialogue becomes one's own when appropriated from dialogue with others, their own voices emerging from the voices associated with occupants of social roles. This coincides with what Vygotsky ([1934] 1962) claims is a stage in language evolution, in which outer dialogue (exchanges with others) precedes internal dialogue (self-talk as cognitive strategy).[5]

The findings of this study may also be of clinical significance, as they might help therapists identify the functions of echolalia in autism speech, which are usually an important indicator for assessment and treatment. The verbal formulae commonly echoed in autism speech are often very ingrained in people's minds and very salient in ordinary speech (also by typically developing children, Lieven et al. 1992). This study may also inform therapeutic interventions to help children with ASD handle or improve their communicative practices, which should also help caregivers, i.e., therapists and families alike, learn how to best interact with them. In sum, the instances of functional echolalia examined here suggest that children with ASD try to communicate and do so in specific circumstances. Echolalia is undoubtedly a symptom of autism, but it may also be the key to effective intervention.

[5] Esther Pascual needs to be acknowledged for this idea, which was discussed during our communication on the paper "Functional echolalia in autism speech: Verbal formulae and repeated prior utterances as communicative and cognitive strategies" (In preparation).

Chapter 5 The Production of Verbal Formulae and its Relation with General Language Ability in High vs. Low-verbal Children with ASD

This chapter presents study 2, that is, the quantitative exploration of verbal formulae produced by 63 Chinese pre-school children with ASD. First, this chapter introduces the research questions and objectives of this study, after that, the methods (i.e., the participants, the materials, the protocol, and the procedure) are presented. In the results, the correlation between formula production and general language ability (i.e., expressive vocabulary size and the command of grammatical categories) is examined. The positive correlation reveals the significant differences between the high-verbal (n=41) and low-verbal (n=22) children with ASD in the average amounts, the relevance, the complexity, and the creativity of verbal formulae. In the discussion section, verbal formulae are illustrated as an acquisition strategy in autism speech, and the important role of formulae in lexicon is also indicated.

5.1 Introduction

The results on the sources of echolalia in study 1 showed that most echolalic utterances are manifested as socio-communicative formulae or socio-cultural emblems, so most of the elicited echolalia are fixed expressions recognizable by most or all members of the linguistic community (see Chapter 4). However, verbal formulae, as the main source of echolalia, has been paid little attention. Thus, as the successive research of

study 1, study 2 aims to answer two research questions: 1) What's the relation between the production of formulae and the participants' general language ability (i.e., the expressive vocabulary size and the command of grammatical categories)? 2) If there are positive or negative correlations between the two, and if so, what are the differences in the production of formulae between high-verbal and low-verbal children with ASD?

This study aims to examine the correlations between the production of formulaic language and the ASD children's language ability, and then compares the performance in formula production between high-verbal and low-verbal children with ASD. The hypothesis is that there will be a strong positive correlation between formula production and the language ability of ASD children, because this has been demonstrated regarding the language of typically developing children (Nelson 1973; Plunkett 1991; Lieven et al. 1992; Hickey 1993; Wray & Perkins 2000; as reviewed in Chapter 2). A high proportional production of formulaic language in autism speech is assumed, but one that varies in children with ASD who are at different levels of verbal competence. Also, the expectation is that the high-verbal ASD children will produce many more and more relevant formulae than their low-verbal counterparts.

This study focuses on verbal formulae that are widely recognized by the entire linguistic community and that are thus part of the language, as opposed to part of a given child's individual repertoire. Formulaic expressions that can only be recognized by the close circle of the ASD children studied (e.g., caregivers, therapists), i.e., echoes from specific utterances heard in the child's life or belonging to the specific idiolect of the child's immediate relations, are discussed in Chapter 4 on functional echolalia. The

amount and percentages (i.e., the frequency), relevance (relevant vs. non-relevant to the target stimuli), complexity (isolated vs. embedded), and creativity (exact vs. modified) of formulae are analyzed so as to discern the children's association between given formulae and the ritualized conversational patterns commonly associated with them. For example, upon being presented with the image of a delivery boy, one child enacted the customer receiving the package, the target referent being the addressee (e.g., 谢谢你！ "Thank you!"). The child thus managed to identify the entire social-communicative situation prototypically associated with one element (i.e., a delivery man). Identifying such prototypical or community-wide formulae deepens our understanding of formula use in normal vs. pathological language. At the same time, this study narrows in on the relations between formula production and general linguistic ability (i.e., expressive vocabulary, the use of decontextualized language, the command of grammatical morphemes, word combination, mean length of utterance, and sentence complexity).

To my knowledge, no research has explored the quantitative frequency of formulaic use in autism speech with large sample size, even though verbal individuals with autism are known to frequently use ritualized or routinized chunks in their communication. Thus, this study might be able to fill the gap in the research of formulaicity, which helps deepen the understanding of formula itself. And the explorations on its role in autism speech also help researchers refresh their insight on formulaic language in children with ASD.

5.2 Methods

In order to address the research questions mentioned above, study 2 applies a combining research methodology to explore the production and the role of formulae in autism speech, which includes two standardized measures and the designed elicitation experiment. This section first presents the information of the participants assessed via the ABC and CDI, then introduces the materials, the protocol (i.e., the identification criteria adapted based on the characteristics of Mandarin Chinese and the classifications), and the procedure.

5.2.1 Participants

In this study, 90 Mandarin-speaking preschool children with ASD were recruited from two autism therapy centers in Zhejiang province, mainland China. 18 participants were from Zhejiang provincial children's early intervention center - "Green Apple Home" in Hangzhou, and 72 were from *Yi lin* "Elim for Autism" therapy center in Ningbo. Out of these 90 children, 27 were eliminated from the final dataset. Specifically: 16 children who did not finish the whole test; 5 who failed to meet the ASD diagnosis; 3 reported not to be familiar with our test stimuli and thus were not able to recognize the stimuli images; and 3 children whose parents submitted incomplete inventory reports on their language assessment. The final dataset thus consisted of 63 participants. These averaged 58.89 months (SD=8.89), ranging from 42 to 78 months. There was a preponderance of boys compared with girls (i.e., 49 boys and 14 girls), which is

representative of the autism population since the great majority of individuals with ASD are male.

Table 5.1 below presents the participants' basic background information, including their chronological age in month, their rating scores on the Autism Behavior Checklist (ABC), and their total vocabulary production scores on the PCDI, as well as the age of vocabulary-matched typically developing children. The ABC scores help to double-check their diagnosis of ASD (the mean ABC scores=55>31).

Furthermore, the comparison of the vocabulary scores between the participants with ASD and the vocabulary-matched typically developing children in the norms by Tardif et al. (2008) shows that even though these 63 children with ASD in this study developed relatively good vocabulary production, they still lag behind their vocabulary-matched typically developing toddlers for 35 months in average. Hence, the vocabulary of these 63 children with ASD is equivalent to that of those younger than them for around 3 years of age (Vocabulary production scores: ASD: 551±181.99 vs. typically developing 24 months: 514±202.11, t=0.818, p=.509>.05, d=81). In addition, the standard deviation of the total vocabulary scores in both the ASD children (SD=181.99) and the TD norm (SD=202.22) is quite large. The former shows a great heterogeneity in the group of 63 ASD children aging from 3 to 6 years old. The latter is because of limited raw data reported public in the TD norm, so the several data I got already involves large variation.

Table 5.1 Characteristics of 63 participants with ASD and the matched typically developing (TD) children in Tardif et al. (2008)

ASD (n=63)	**Age in months**	**ABC Scores**	**PCDI vocabulary production scores in ASD**	**PCDI vocabulary production scores in matched TD children in the norms by Tardif et al. (2008)** (n=35)
Mean (SD)	58.59 (8.89)	55.71 (18.06)	551 (181.99)	TD 24 months: 514 (202.11)
Range	42-78	31-100	34-779	79-772

Following Su et al. (2018), I characterized children with ASD who produced more than 500 words as high-verbal. Thus, the 63 participants recruited in this study were divided into low-verbal (LV, 0-499 words, n=22) and high-verbal (HV, 500+ words, n=41) ASD children. Significant vocabulary discrepancies were found between the participants, as observed in the following histogram (i.e., **Figure 5.1**).

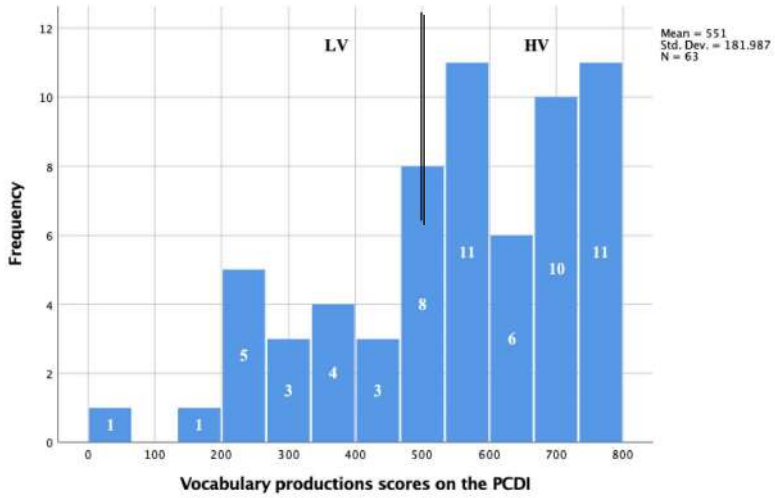

Figure 5.1 Distribution of vocabulary production scores in high-verbal and low-verbal children with ASD

(a) Participants' delays in five behavioral domains assessed via the ABC

Regarding the participants recruited in study 2 on the exploration of formulaic production by children with ASD, their total ABC scores are relatively high, reaching 55 on average. As shown in **Table 5.2**, the ABC scores in these 63 participants vary from 32 to 100, revealing the significant heterogeneity in the group of children with ASD.

Table 5.2 Characteristics of 63 participants on five subscales of the Autism Behavior Checklist (ABC)

	Five sub-scales in the Autism Behavior Checklist					
ASD (n=63)	**Sensory Behaviors** (n=9)	**Relating Behaviors** (n=12)	**Body & Object Use Behaviors** (n=12)	**Language Behaviors** (n=13)	**Social/self-help Behaviors** (n=11)	**Total** (n=57)
Mean	6.89	14.62	8.32	16.03	9.89	55.71
(SD)	(3.79)	(6.12)	(6.94)	(4.77)	(4.85)	(18.06)
Range	0-15	0-27	0-28	7-26	0-22	32-100

In conclusion, the ABC scores show how the participants are delayed in different behavioral domains. The mean scores, the standard deviation, and the range of the ABC sub-scale scores are presented accordingly above. As a screening instrument, this checklist helps the experimenter identify the participants' level of autistic behavior, and helps for further data interpretation.

(b) Participants' general language ability assessed via the PCDI-words and sentences

The vocabulary production scores on five main semantic categories on the PCDI-words and sentences are compared between the high-verbal vs. low-verbal children with ASD, as shown in **Table 5.3**. In addition, the scores on the grammatical sub-scales are shown in **Table 5.4**.

When comparing the scores between the high-verbal and low-verbal groups, significant differences were found in the total expressive vocabulary size between these two groups varying in verbal abilities (t=-11.480, p<.001, d=61). Specifically, the differences between high-verbal and low-verbal groups in the production of nouns (t=-8.625, p<.001), verbs (t=-11.286, p<.001), pronouns (t=-6.787, p<.001), classifiers (t=-7.128, p<.001), as well as question words (t=-6.499, p<.001) were all significant (ps<.001). This is not surprising, since this study divided these two groups initially based on their total vocabulary production scores. **Table 5.3** presents the descriptive data of the five semantic categories between the high-verbal and low-verbal children with ASD, including the mean scores, standard deviation, and the range.

Table 5.3 Comparisons of five main lexical subcategories and the total vocabulary production scores between low-verbal (LV) and high-verbal (HV) groups

The Putonghua Communicative Development Inventory-Words and Sentences												
Semantic categories	Nouns (n=371)		Verbs (n=194)		Pronouns (n=24)		Classifiers (n=20)		Question words (n=12)		Total (n=799)	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Mean	232.50	338.44	57.55	155.83	2.64	13.71	1.95	12.32	0.64	7.22	347.23	660.34
SD	71.19	25.17	35.87	31.31	2.67	7.37	3.06	6.42	1.36	4.63	121.23	90.12
Range	13-318	279-371	5-122	89-194	0-11	0-24	0-12	0-20	0-5	0-12	34-494	506-799

Finally, according to their scores in the grammatical part of the PCDI, the children with ASD in this study performed relatively good in the subcategory of 'decontextualized language' (i.e., the frequencies of the child's references to past, future, and absent objects and events), as well as in using grammatical morphemes (e.g., the perfective/experiential aspect markers 了 *le* and 过 *guo*, in the subcategory of 'sentences and grammar'). After calculating the mean length of three examples of the longest sentences uttered by the participants, the average mean sentence length was around 4.69. This means that the participants in this study who are around five years old can produce sentences with only five words on average. Furthermore, their parents were asked to select one from a pair of sentences contrasting in complexity to indicate how the child currently speaks in the sub-scale of sentence complexity. These subsections on grammatical categories were introduced in **Table 4.1** in Chapter 4.

In **Table 5.4**, only the sentence complexity scores of children with ASD are compared with the typically developing norms because the exact mean length of utterance (MLU) scores in the norms were not available. The comparison between the mean score of sentence complexity for children with ASD and the vocabulary-matched typically developing children in the norms of Tardif et al. (2008) reveals that the sentence complexity in these 63 participants aging at 58 months, is in line with typically developing children at 25 months old (p=.50>.05). So, the participants with ASD in study 2 lagged behind their vocabulary-matched typically developing children for 33 months of development.

Table 5.4 Mean Length of Utterance (SD) and sentence complexity scores of 63 participants with ASD and the matched typically developing (TD) children in Tardif et al. (2008)

Grammatical Categories	ASD 58.59 months (n=63)	TD 25 months (n=35)	t	d
Mean Length of Utterance	4.69 (3.08)	-	-	-
Sentence complexity (n=27)	47.90 (20.54)	51.9 (22.9)	0.678	81

Thus, in the above two tables (i.e., **Tables 5.3** and **5.4**), the mean vocabulary scores of five semantic categories are compared between the high-verbal and low-verbal children with ASD. The scores of grammatical categories were compared between children with ASD and their vocabulary-matched typically developing children. This offers more insightful language information on these participants.

5.2.2 Materials

Study 2 applied the same experimental materials with study 1. Briefly, the materials are 24 carefully designed stimuli images, including 12 professions or individuals and 12 entities that Chinese children with ASD are familiar with and can recognize well. For further information about the selection and design of experimental materials, please refer back to **Figure 3.5** in Chapter 3.

After the standard tests and the elicitation experiment, a five-score Likert scale test on the children's familiarity with the concepts and level of recognition of these designed images was administered (see **Appendix 2**), to prevent data contamination. Similar to study 1, all the 63 participants in study 2 were reported to be quite familiar

with the concepts (Mean=3.92, SD=0.60) and to be able to recognize the images well (Mean=3.91, SD=0.58).

5.2.3 Protocol

This study applied the same elicitation experiment as study 1, presented in Chapter 4. In the elicitation experiment, the visual stimuli were presented equally to both the high-verbal and low-verbal ASD children. All the participants had to answer two questions on each in Mandarin, one was the naming question (i.e., 他是谁？/这是什么, "Who's this?" / "What is this?") and the other was the description question (i.e., 他会干什么？/ 这个可以用来干什么？ "What does s/he do" / "What's it used for?"). The entire elicitation experiment was video and audio recorded in familiar surroundings in which the participants receive daily therapy.

Apart from the elicitation experiment, this section also introduces the criteria of data identification and the coding symbols of classification, which will help readers better understand the data interpretation and analysis in the results.

(a) Identification criteria

The formulae explored in this study include socio-cultural emblems (e.g., 生日快乐! "Happy birthday!") and socio-communicative formulae (e.g., 喝水, "Drink/Have some water"), as well as entrenched multi-word nominal phrase (e.g., 日常用品类, "Daily necessities"), and onomatopoeia (e.g., the imitation of a car's whistling sound *du du ba ba*, a mobile phone's incoming call *ding ding ding*, or the waiting ring *du du*

du “Beep beep beep”). Similar to study 1, this study follows the coding rules applied in Dornelas & Pascual (2016), Pascual et al. (2017), and Dornelas (2018) in including onomatopoeia, which constitutes a repetition of a previously heard sound.

The difficulty for identification lies in the inability to differentiate formulaic sequences from novel strings because they can be grammatically regular and semantically transparent. Because of the intractability of formulae, many formulae escape identification (Wray & Namba 2003), and more specific conditions are needed to identify not only prototypical formulae but also some non-typical ones (Wong Fillmore, 1976). *Prototypical* refers to verbal formulae that can be easily identified or recognized by a wide community (e.g., Happy birthday), instead of those that can only be identified by a specific small group (e.g., the child’s close circle, Peppa Pig fans).

Thus, many researchers have proposed criteria from different linguistic perspectives to identify formulae. Peters (1983) uses three criteria for formula identification: 1) if the expression is ‘an idiosyncratic chunk’; 2) if it’s a ‘community-wide formula’; and 3) if it’s situationally dependent. Based on Peters’ criteria, Jackendoff (1983:135) describes a preference system containing a cluster of nine interrelated conditions under the following headings: 1) length of units; 2) frequency of occurrence; and 3) appropriateness of use. The use of such a preference system makes a clear distinction between necessary conditions and typical conditions in formula identification (Hicky 1993). The built-up criteria make it possible to quantify the degree of stereotype, productivity, or repetitiveness in language disorders (Perkins 1994). Wray (2002) identifies four major characteristics in the existing descriptions of

formulaic sequences in the literature: ‘form’, ‘meaning’, ‘function’, and ‘provenance’. Wray and Namba (2003) put forward eleven systematic diagnostic criteria for identifying formulae from grammatical, structural, lexical, semantic, and pragmatic perspectives.

The criteria for identification of formulae in this study followed the standard diagnostic characteristics used in prior studies (Peters 1983; Van Lancker Sidtis 2004; Wood 2010: 132; Pascual et al. 2017), especially following 11 criteria presented in Wray & Namba (2003) and his other studies on formulae (Wray & Perkins 2000; Wray 2002, 2009). Furthermore, the criteria were expanded based on the specialties of Mandarin, in order to adapt the criteria to the characteristics of the Chinese language. For example, some grammatical criteria in Wray and Namba (2003) were abandoned because some syntactic identifiable grammatical features are unavailable in Chinese. So, they cannot be used as a criterion for Chinese language data, such as ‘grammatical irregularity’, ‘lexical indication’ (i.e., the speaker/writer, or someone else has marked this word string grammatically or lexically in a way that gives it special status as a unit), and ‘derivation’ of Chinese characters. In addition, ‘idiolect’, ‘inappropriate application’, and ‘mismatch with maturation’ were also not measured here, because it was hard to set relative standards for these criteria in Chinese, and they were unavailable for the designed materials. Except for these criteria, ‘cultural-specified features’, ‘conventionality’, and ‘formulaic construction’ were added based on the characteristics of the Chinese dataset in this study. Finally, the following 7 criteria were used for the identification of a verbal formula in the Chinese dataset:

A. Semantic opacity: part or all of the word string lacks semantic transparency (e.g., 老司机 "old driver", which can refer to a driver's age is old, or refer to people who are experienced in certain areas or fields).

B. Situation/register specificity: the word string is situationally dependent, like a socio-communicative expression (e.g., 喂，你好！ "Hello, how are you?", which is associated with a phone call situation).

C. Pragmatic function: the word string has a meaning as a whole, but functions differently in different communications (e.g., 看病 can refer to a doctor "check diseases", and it can also refer to a patient going to the hospital to "see a doctor").

D. Performance indication: the speaker accompanies the word string with gestures and intonation, that gives it special status as a multimodal unit (e.g., one child shouting with frightening rising intonation: 喷水，发射，把火泼灭！ "Spray water, shooting, let's put out the fire!". This could be an echoed expression from the witness of the fire or from the firefighters shouting slogans to call for actions together).

E. Cultural-specified features: the word string is a socio-cultural emblem known or shared by the entire linguistic community (e.g., 生日快乐! "Happy birthday!").

F. Conventionality (or stability, fixedness): the word string is firmly established, highly fixed or frozen (e.g., 打电话 "Make a call").

G. Formulaic construction: the phrase construction is entrenched, with a given lexical slot being flexible that can be filled with different lexical items (e.g., 睡午觉 "Lit.: sleep afternoon sleep; Have an afternoon nap", here in the Chinese

expression, the character 午 "afternoon" is inserted into the formulaic frame 睡觉 "Lit.: sleep sleep; Go to bed/sleep").

To help understand the diagnostic criteria presented above, I prefer to take the standardized routine 生日快乐！ "Happy birthday!" as an example. This formula is associated with a given day and social scene (B) and shared across the culture (E), and it as a whole has a function of congratulating the addressee on their birthday (C). It is often said with gestures, facial expressions, and special prosodic features (e.g., rising intonation) and often even sung (D), as a fixed expression (F). However, following Wray & Namba (2003, as discussed above), not all criteria can or should be applied to the formulaic sequences at the same time. Here in this example, "Happy birthday" does not apply the criterion (A) because the semantic meaning is quite transparent in this expression, and it cannot be filled with any other lexical items within this word string (G).

Similar to study 1, two coders are needed and a third coder checks the disagreement when there are variations between coders. Applications of these criteria would significantly strengthen the internal reliability (Wood 2010). Fortunately, the reliability between the two coders and the third checker reached great significance ($p<.01$), because most of the formulae produced by the participants in this study were frequently occurring conventional ones, which made them particularly easy to identify based on the criteria listed above. The criteria of formula identification help with the

data discussion at the early stages, and also help with the data analysis later, which is an essential part of the methodology.

(b) Classification criteria

The forms, relevance, and creativity level of the verbal formulae were coded. Regarding the form, this research distinguished between 1) Verbal formula (isolated): typical socio-cultural and socio-communicative fixed expressions that can be recognized by the wide community and appear alone and exactly in their known form (e.g., 喝水, "Drink water"); 2) Verbal formula (embedded): typical verbal formulae that appear embedded in a larger phrasal, clausal or sentential structure (e.g., 这是用来喝水的, "It is used to drink water"), and some other occurrences.

As for the relevance of the verbal formulae produced, they were coded as: 1) relevant vs. non-relevant, depending on whether the formula was or was not related to the target image or an associated frame (e.g. "Happy birthday!" is relevant to the birthday cake; "Drink water" is relevant to the water glass; neither are relevant to the driver); or 2) ambiguous (relevant/non-relevant): when there is no apparent relation between the formula and the target image, but there might be one in the child's life. Then, the creativity of the formulae was coded as 1) exact: the words in the formula are uttered exactly as they are known by the wide linguistic community (e.g., 睡觉, "Go to sleep/bed" for a bed); or 2) modified: one word or some words are added or embedded into the original formulaic construction (e.g., 睡午觉, "Have an afternoon nap" for the stimuli image of bed).

5.2.4 Procedure

The procedure in this study is the same as that for study 1: parents of the participants complete two standardized measures, reporting their children's delay in behavioral domains via the ABC, and the general language ability via the PCDI-words and sentences. After the assessment on their delay in behavioral domains and language abilities, the participants are required to take an elicitation experiment, containing the naming and description tasks demonstrated as two test questions. For further detailed information on the procedure, please refer back to the section of methods in Chapter 4.

5.3 Results

In accordance to the research questions of this study, the results are divided into two main sections: first examining the correlations between the production of verbal formulae and the general language ability of children with ASD; second comparing the differences of formula production between the high-verbal and the low-verbal ASD children.

5.3.1 Relation between formula production and general language ability

This section examines the relation between the production of formulae and the participants' chronological age, as well as the relation between formula production and general language ability (i.e., expressive vocabulary and the command of grammatical categories). Specifically, this subsection includes three aspects of analysis, respectively exploring the relations: (a) between formula production and chronological age; (b)

between formula production and expressive vocabulary (i.e., five lexical categories: nouns, verbs, pronouns, classifiers, and questions words); (c) between formula production and grammatical competence (i.e., decontextualized language,[6] the use of grammatical morphemes, mean length of utterance, and sentence complexity).

(a) Relations between formula production and chronological age

Researchers believe that there is a positive correlation between language development and chronological age in child language acquisition. Formula production is regarded as an indicator of development for typically developing children to move from a holophrase to the multi-word stage. However, there is no age effect in the language development of children with ASD. Thus, chronological age does not seem to be a valid impactor, due to the significant heterogeneity in this atypical group. Even though a child with ASD may be chronologically older and might have received therapy for a longer time, still, the language development or pragmatic performance of children with ASD cannot be determined by their chronological age.

Moreover, formula production is not a typical characteristic in general language development—some typically developing children do not go through this stage when some children use it as a phase stage (e.g., Nelson 1973; Plunkett 1991; Lieven et al. 1992; Hickey 1993; Wray & Perkins 2000; see Chapter 2). In order to explore if there are any correlations between formula production and chronological age in Chinese

[6] As introduced in Chapter 4, decontextualized language refers to how the child speaks about something that is not in the here and now, i.e., the frequencies of the child's references to absent toys or animals; possession; past events/people; and future events.

children with ASD, the Pearson test was run between the production of different types of formulae and the chronological age of the 63 children with ASD in the pool.

The results show no significant correlations between chronological age and formulae or any types of formulae produced by the children with ASD (*p*s>.05). Consistent with the findings on there being no age effect in language development for children with ASD, no significant correlations were found between the participants' chronological age and the production of formulaic occurrences (r=0.048, *p*=.707>.05), the production of relevant (r=0.058, *p*=.653>.05) and non-relevant formulae (r=0.028, *p*=.828>.05), the production of isolated (r=-0.054, *p*=.673>.05) and embedded formulae (r=0.098, *p*=.445>.05), and the production of exact (r=0.061, *p*=.636>.05) and modified formulae (r=-0.112, *p*=.384>.05), as well as the production of onomatopoeia (r=0.120, *p*=.351>.05). Thus, no age effect was found in formula production, which is consistent with the findings on chronological age reported in prior autism language research.

(b) Relation between formula production and expressive vocabulary

A Pearson correlation analysis revealed a strong positive correlation between the production of verbal formulae and the child's total vocabulary size. This includes five semantic categories selected from 26 semantic categories assessed via the Putonghua Communicative Development Inventory (PCDI)-words and sentences. Significant correlations were found between the total production of verbal formulae and the total vocabulary size (r=0.467, *p*<.001), and specifically between total production of

formulaic occurrences and those five specific semantic categories: nouns (r=0.419, p<.01), verbs (r=0.415, p<.01), pronouns (r=0.394, p<.01), classifiers (r=0.330, p<.01), and question words (r=0.494, p<.001). The results are presented in **Table 5.5**.

Table 5.5 Correlations between formula production and five main lexical categories assessed via the PCDI vocabulary test

Lexical categories	Formulaic occurrences	Relevant formulae	Non-Relevant formulae	Isolated formulae	Embedded formulae	Exact formulae	Modified formulae
Nouns (n=371)	.419**	.421**	.165	.283*	.326**	.421**	.192
Verbs (n=194)	.415**	.418**	.213	.207	.374**	.419**	.170
Pronoun (n=24)	.394**	.381**	.291*	.187	.361**	.401**	.118
Classifier (n=20)	.330**	.334**	.209	.154	.305**	.329**	.180
Question words (n=12)	.494**	.489**	.292*	.247	.444**	.498**	.199
Total (n=799)	.467**	.468**	.240	.263*	.400**	.469**	.211

T-test, *p<.05; **p<.01; ** At the 0.01 level (two-tailed), the correlation is significant.

More specifically, not only were the total occurrences of formula production closely correlated with the general vocabulary scores assessed via the PCDI, but the relevance, complexity, and creativity of verbal formulae also correlated with vocabulary. Most categories of formulae significantly correlated with the five semantic categories of expressive vocabulary.

The production of relevant formulae significantly correlated with total vocabulary size and the five lexical categories; all *p* values were less than 0.01 (see **Table 5.5** above). However, no correlations were found between total vocabulary and the production of ambiguous formulae and modified formulae (*p*s>0.05). Even though the correlation between the production of non-relevant formulae and total vocabulary was not significant, the correlations with pronouns (r=0.291, *p*<.05) and questions words (r=0.292, *p*<.05) were still statistically significant.

As for the relations between expressive vocabulary and the complexity of formulae (i.e., isolated formulae and embedded formulae), significant correlations were found between all five semantic categories and the production of embedded formulae (*p*s<.01). This seems to indicate that the acquisition of different lexical categories matters when more vocabulary knowledge is needed for children with ASD to produce formulae with more complex structures. As for the correlations with the production of exact formulae, only the category of nouns correlated significantly with the production of exact formulae (r=0.283, *p*<.05), while the correlations between the other four lexical categories and the production of isolated formulae were all above 0.05, not reaching the level of significance. This reveals that expressive vocabulary size has an impact on the production of embedded formulae, but not isolated formulae.

In addition, when looking at the creativity of formulae, the relations between expressive vocabulary were also closely correlated with the production of exact formulae (*p*s<.01). In contrast, no correlations were found between expressive vocabulary size and the production of modified formulae (*p*s>.05). This shows that

having a good expressive vocabulary size affects the production of exact formulae, but producing modified formulae may need other language abilities, rather than relying on lexical knowledge only.

These results reveal that vocabulary knowledge is closely related to the production of formulae with different levels of relevance, complexity, and creativity. The findings seem to be consistent with prior studies showing that the production of verbal formulae can be regarded as an alternative path to develop language for some young children (e.g., Brown 1973; Clark 1982; Snow 1986; Lieven et al. 1992, and see the literature review in Chapter 2). Formula production can thus be considered a predictor for lexical development in autism language acquisition.

(c) Relation between formula production and the command of grammatical categories

Significant correlations were also found between the production of verbal formulae and the command of grammatical categories assessed via the PCDI test, including four subtests in the grammatical part of the PCDI-words and sentences (Tardif et al. 2008; see the detailed introduction to the subtests of the grammatical part in Chapter 4). Significant correlations were found between the production of formulae and: 1) decontextualized language use (i.e., references to absent toys/animals; possession; past events/people; and future events; r=0.437, p<.001); 2) the use of grammatical

morphemes (i.e., the use of serial verb constructions,[7] possessives, quantifiers, and aspect markers; r=0.467, p<.001); 3) the ability to combine words (mean length of utterances; r=0.480, p<.001); and 4) sentence complexity (each of the 37 sentence pairs contained a more or a less complicated phrase or sentence for parents to choose, to reflect the child's speech level at the time; r=0.522, p<.001). Thus, all the p values were less than 0.001 (see **Table 5.6**). This showed a strong correlation between the production of formulaic occurrences and the children's command of grammatical categories, as assessed via the PCDI.

[7] A serial verb construction, broadly defined, is a syntactic structure in which two or more verbs are juxtaposed to form a complex predicate to express a series of related actions within a single clause (e.g., Ding et al. 1979: 112-8; Li & Thompson, 1981; Noonan, 1985; Baker, 1989). These have some general characteristics cross-linguistically. An example from Mandarin is the following:

Xiao wang qu da dian hua jiao che le.

Xiao wang go make phone call hire car.

V1 V2 V3

Xiao wang went to make a phone call to hire a taxi.

Table 5.6 Correlations between the production different types of formulaic occurrences and grammatical categories in the PCDI test

Grammatical categories	Total occurrences	Relevant	Non-relevant	Isolated	Embedded	Exact	Modified
Decontextualized language	.437**	.410**	.371**	0.248	.373**	.435**	.248*
The use of grammatical morphemes	.467**	.436**	.358**	0.224	.428**	.470**	0.205
Mean length of utterances	.480**	.444**	.354**	0.115	.519**	.480**	.248*
Sentence complexity	.522**	.504**	.317*	0.149	.548**	.536**	0.117

T-test, *p<.05; **p<.01; ** At the 0.01 level (two-tailed), the correlation is significant.

The production of relevant and non-relevant formulae was closely correlated with the aforementioned four subtests in the grammatical part of the PCDI-words and sentences (Tardif et al. 2008). The *p* values were all less than 0.001 with relevant formulae, and less than 0.05 with non-relevant formulae. In contrast, there were no significant correlations between any grammatical subtests with the production of ambiguous formulae and formulae used as self-talk (*p*s>.05).

Regarding the complexity of formulae, the production of embedded verbal formulae showed strong correlations with: 1) decontextualized language use (r=0.373, *p*<.01); 2) the use of grammatical morphemes; r=0.428, *p*<.001); 3) the ability to combine words (mean length of utterances; r=0.519, *p*<.001); and 4) sentence complexity (r=0.548, *p*<.001). On the contrary, the production of isolated verbal formulae did not correlate with any of the subtest scores in the grammatical part of the PCDI (*p*s>.05). This seems reasonable since the children's grammatical competence

was closely related to their production of formulae in embedded structures, which naturally required children's more advanced abilities in using grammatical categories.

As for the correlations with creativity of verbal formulae, the production of exact verbal formulae strongly correlated with: 1) decontextualized language use (r=0.435, p<.001); 2) the use of grammatical morphemes (r=0.470, p<.001); 3) the ability to combine words (mean length of utterances; r=0.480, p<.001); and 4) sentence complexity (r=0.536, p<.001). Please see **Table 5.6** above. The production of modified verbal formulae only correlated with the use of decontextualized language (r=0.248, p<.05) and the ability to combine words (mean length of utterances; r=0.248, p<.05). By contrast, no correlations were found between the production of modified formulae and the use of grammatical morphemes (r=0.205, p>.05), or sentence complexity (r=0.117, p>.05).

Overall, the correlations presented above indicate that the grammatical language abilities of the children with ASD in this study had an impact on the amount, relevance, complexity, and creativity of the formulae they produced. In sum, there was no age effect on formula production. However, the correlations between formula production and expressive vocabulary and the command of grammatical categories were all significant, revealing a positive impact of language ability on formula production.

5.3.2 Formula production between high-verbal vs. low-verbal children with ASD

In this section, the production of different types of formulae are analyzed between the two ASD groups varying in verbal abilities. This subsection thus includes four aspects

of data analysis, containing explorations of the prevalence of formula production (i.e., the average and total amounts, as well as the percentages of formula production); their relevance (relevant vs. non-relevant vs. ambiguous vs. self-talk); their complexity (isolated vs. embedded); and the creativity of formulae (exact vs. modified). This is done by comparing the performance of Mandarin-speaking high-verbal (n=41) vs. low-verbal (n=22) children with ASD within groups and between groups, respectively. The Independent-samples *t* tests were used in the data analysis when comparing the high-verbal and low-verbal groups, so the number of the two groups was controlled.

(a) The average amounts and percentages of formulaic occurrences

The production of fixed formulae that are familiar to most or all in the linguistic community (i.e., classified as 'widely recognized formulae'), and occurrences that are not widely known (i.e., classified as 'other occurrences'), as well as the production of onomatopoeia were compared between high-verbal and low-verbal children with ASD. These occurrences were coded by two assessors, combining the 7 objective diagnostic criteria described in the section of methods above.

As **Table 5.7** presents, the total production of prototypical formulae that are widely recognizable by the whole community reached a high proportion, making up more than 90% of the whole (HV: 75.69% and LV 17.83%). The productions that cannot be identified by a wide community ('Other occurrences') constituted less than 6% (HV: 4.08% and LV: 1.77%). The children with ASD in this study also produced a small percentage of onomatopoeia (e.g., imitations of an object's sound; HV: 0.44%

and LV: 0.18%). Thus, both the high-verbal and low-verbal children with ASD produced a significantly higher percentage of widely recognized formulae than other occurrences and onomatopoeia.

Table 5.7 Formulaic occurrences between high-verbal (HV) and low-verbal (LV) children with ASD

Categories	Widely recognized formulae	Other occurrences	Onomatopoeia
HV (n=41)	75.69%	4.08%	0.44%
LV (n=22)	17.83%	1.77%	0.19%
Total	93.52%	5.85%	0.63%

As shown in **Figure 5.2**, the comparison between the two verbal groups reveals significant differences in the production of 'widely recognized formulae'. The high-verbal children with ASD produced a significantly larger number (twice the average amount) of formulaic occurrences than their counterparts with relatively lower verbal abilities (HV: 20.80 vs. LV: 9.14; t=3.966, p<.001). However, no differences were found in the average production of 'other occurrences' (t=0.469, p=.641>.05) or 'onomatopoeia' (t=0.320, p=.750>.05) between high-verbal vs. low-verbal children with ASD.

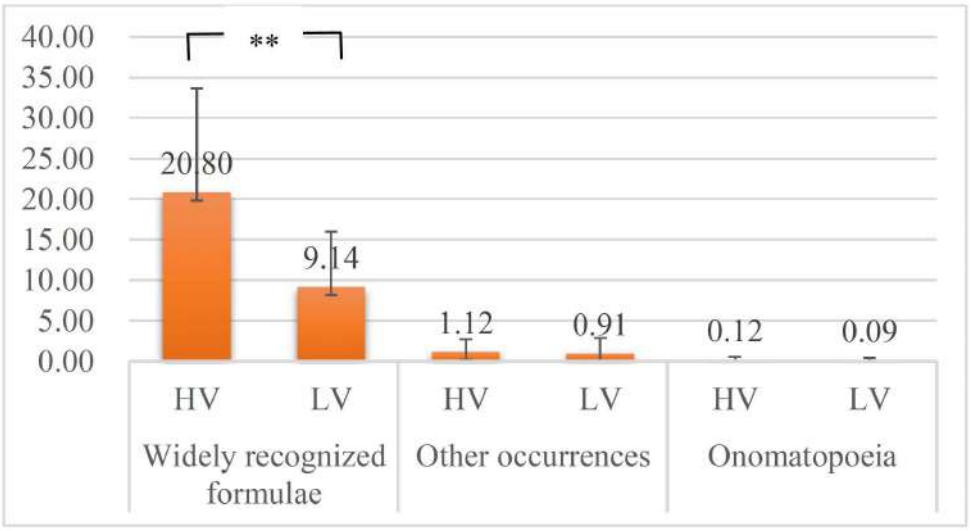

Figure 5.2 Average formulaic occurrences produced by high-verbal (HV) vs. low-verbal (LV) children with ASD

Thus, the data show that the high-verbal children with ASD in this study produced significantly more formulaic occurrences that are widely recognized by the whole or wide speech community. The significant differences in formula production between the two groups confirm the finding on the significant correlations between formulae and expressive vocabulary ability that was presented in the last subsection. Thus, this finding points to the important role of formula production in the development of expressive vocabulary for children with ASD.

(b) Relevance of verbal formulae

Almost all formulae the high-verbal vs. low-verbal ASD children in this study produced were relevant to the test images or were related to these images' associative conversation frames or social rituals (e.g., 喝水, "Drink/have some water" for 'glass'), contributing around 90%. The production of non-relevant formulae (e.g., 听音乐,

"Listen to music" for 'nurse') made up less than 4%, and the production of ambiguous formulae (e.g., 除毛, "(to) Brush off (the) hair(s)" for 'towel') constituted 5.60%. In addition, 6 occurrences were produced neither as ways to answer the questions nor to keep the conversation going, but as cognitive aids. Such examples were coded as 'self-talk' strategy (i.e., 想一想, "Think about it"; 0.57%). Children with ASD used these to speak to themselves when they could not provide a response right away, perhaps as a cognitive strategy to help them think about the right answer, a phenomenon that was discussed in more detail in Chapter 4. Except for relevant formulae, the other three categories together only made up a little over 10% of the total.

In-group comparisons of the average production of relevant formulae and other categories (i.e., non-relevant, ambiguous formulae, and formulae used for self-talk), all reached great significances in the data of both the high-verbal and low-verbal children with ASD (*p*s<.001). In the production of formulae in high-verbal children with ASD, they produced a high percentage of formulae that are relevant to the target stimuli (72.96% relevant formulae, 3.61% non-relevant formulae, 3.79% ambiguous formulae, and 0.57% formulae for self-talk). In the data of low-verbal children with ASD, 16.79% of formulae they uttered were relevant, 0.38% were non-relevant, 1.90% were ambiguous, and zero for self-talk formulae (see **Tables 5.8**). The data show that both the high-verbal and low-verbal ASD groups produced significantly more relevant formulae than the other three categories varying in relevance (*p*s<.001). Thus, most of the verbal formulae produced by the Chinese children with ASD in this study were related to the topic referents in the elicitation experiment.

Table 5.8 Relevance of formulaic occurrences by high-verbal (HV) vs. low-verbal (LV) children with ASD

Relevance	Relevant	Non-relevant	Ambiguous	Self-talk
HV (n=41)	72.96%	3.61%	3.79%	0.57%
LV (n=22)	16.79%	0.38%	1.90%	0.00%
Total	89.75%	3.99%	5.69%	0.57%

The between-group comparison of the average production of relevant formulae shows that the high-verbal children with ASD produced more than twice the relevant verbal formulae produced by their low-verbal counterparts (t=3.978, $p<.001$, see **Figure 5.3**). This finding shows that compared to low-verbal children with ASD, high-verbal children with ASD produced significantly more formulae that were relevant to the test images or their associative socio-cultural or socio-communicative situations (e.g., 晚安, "Good night!" for naming a bed; 吃饭, "Have meals" for naming a bowl). However, the difference in the average production of non-relevant verbal formulae between these two groups did not reach significance between the high-verbal and low-verbal groups (t=1.659, $p=.102>.05$). Neither did the average production of ambiguous formulae (t=0.156, $p=.877>.05$) or verbal formulae used as self-talk strategy (t=0.863, $p=.392>.05$). In addition, 'self-talk' verbal formulae seemed to be produced mainly to maintain the conversation or as cognitive strategy to elicit the appropriate answers for the questions (cf. Xie, Pascual, and Oakley, in preparation, and see Chapter 4 on the qualitative analysis of the communicative and cognitive functions of echolalia).

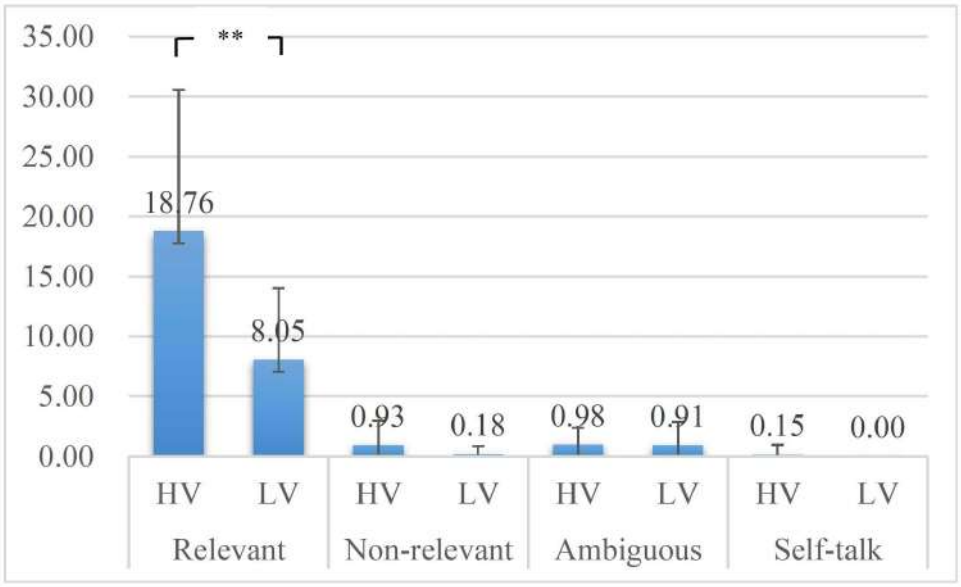

Figure 5.3 Average formulaic occurrences varying in relevance by high-verbal (HV) vs. low-verbal (LV) children with ASD

Thus, the results show that both the high-verbal and low-verbal children with ASD in this study produced more relevant formulae that were related to the communicative frames people commonly associate with the referents of the target images. Furthermore, a significant difference was found in the production of relevant formulae between these two verbal groups. This finding indicates that the verbal abilities of children with ASD also have an impact on the relevance of the formulae they produce.

(c) Complexity of verbal formulae

This subsection presents the comparison between the production of isolated formulae, i.e., fixed linguistic units that usually appear as one conversational turn (e.g., 生日快乐, "Happy birthday"), and embedded formulae, i.e., formulaic sequences integrated into a larger grammatical structure (e.g., 他会看病, "He can check disease(s)", the

formula check disease(s) associated with 'doctor', being embedded into the sentence in the example).

Within-group comparison of the production of isolated vs. embedded formulae indicated a higher proportional production of isolated formulae (~60%) than embedded formulae (~40%). Both the high-verbal and low-verbal children with ASD produced a little higher percentage of isolated than embedded formulae (HV: 44.88% isolated vs. 36.05% embedded; LV: 15.56% isolated vs. 3.51% embedded; see **Table 5.9**). However, no significant differences were found in the production of isolated vs. embedded verbal formulae within the high-verbal group (r=-0.079, p=.624>.05) or within the low-verbal group (r=0.105, p=.643>.05).

Table 5.9 Percentages of isolated vs. embedded formulae production by high-verbal (HV) vs. low-verbal (LV) children with ASD

Complexity	Isolated	Embedded	Total
HV (n=41)	44.88%	36.05%	80.93%
LV (n=22)	15.56%	3.51%	19.07%
Total	60.44%	39.56%	100.00%

The between-group comparison shows that the high-verbal children with ASD in this study produced a higher proportion of both isolated and embedded formulae than the ASD children with lower verbal abilities. There were significant differences in the production of isolated verbal formulae (t=2.322, p=.024<.05) and embedded verbal formulae (t=3.082, p=.003<.05) between the two groups, as shown in **Figure 5.4**.

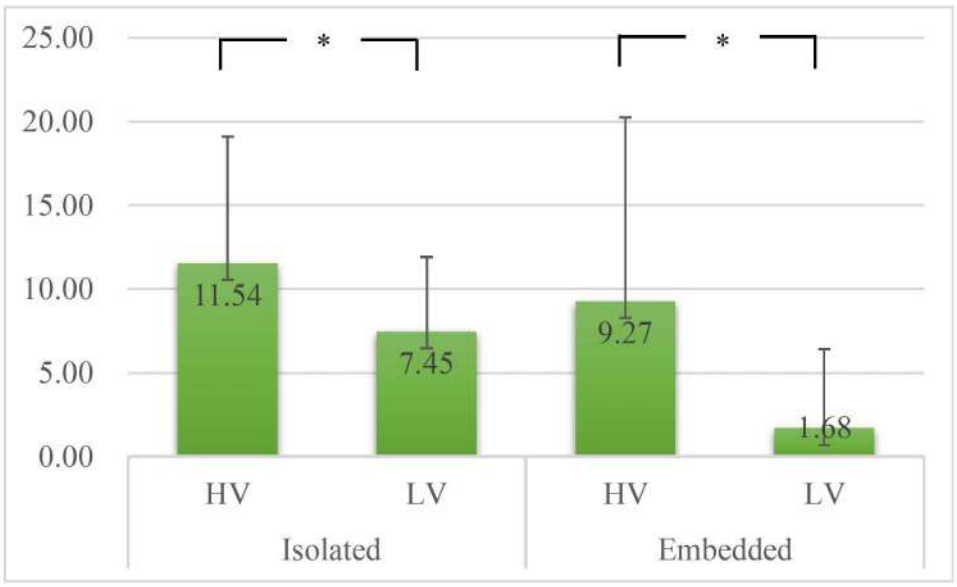

Figure 5.4 Average isolated and embedded formulae produced by high-verbal (HV) vs. low-verbal (LV) children with ASD

These results show that children with ASD with a better expressive vocabulary (high-verbal children) can produce formulae in more complex and complicated sentence structures (i.e., embedded formulae). Indeed, the high-verbal children with ASD in this elicitation study produced verbal formulae embedded in a sentence as a way to answer the task's questions. The much lower proportional production of embedded formulae in the low-verbal group seems to indicate that it is harder for ASD children to produce complex structures involving formulae when their verbal abilities are limited.

The percentages of isolated vs. embedded formulae produced by the high-verbal vs. low-verbal ASD children are shown via the within-group and between-group comparisons above. The following subsection presents the creativity of verbal formulae, also focusing on the differences between the two ASD groups varying in verbal abilities.

(d) Creativity of verbal formulae

As for creativity, the level of creativity as exact vs. modified verbal formulae are differentiated. Exact verbal formulae are fixed, frozen expressions, which appear exactly in the same form as in the entrenched linguistic unit recognizable by the wide community (e.g., "Happy birthday to you!"). By contrast, verbal formulae may be produced in a modified form (either saying less than in the original fixed phrase, e.g., "Birthday to you!", or something different, e.g., "Happy bi-day to tou!", or changing the formula with some additional linguistic elements (e.g., "Happy birthday to mommy/daddy").

The production of formulaic occurrences varying in creativity was compared between the high-verbal and low-verbal children with ASD. **Table 5.10** shows that the high-verbal ASD group produced more exact than modified formulae (78.65% vs. 2.28%; r=0.447, $p<.01$), and so does in the low-verbal group (18.31% vs. 0.76%; r=0.720, $p<.001$). Thus, the data show that both groups produced a much higher percentage of exact formulae than modified formulaic sequences (Total: 96.96% exact vs. 3.04% modified formulae). This means that most formulae produced by the ASD participants in this study are without modifications on the frozen fixed expressions and are thus expressed exactly as they are known by the wide community.

Table 5.10 Percentages of exact vs. modified formulae by high-verbal (HV) vs. low-verbal (LV) children with ASD

Creativity	Exact	Modified	Total
HV (n=41)	78.65%	2.28%	80.93%
LV (n=22)	18.31%	0.76%	19.07%
Total	96.96%	3.04%	100.00%

Between-group comparisons on the production of formulae between the two groups demonstrate that the high-verbal children with ASD in this study produced a significantly higher proportion of exact formulae than the low-verbal counterparts (t=4.098, p<.001). By contrast, both the high-verbal and low-verbal ASD children produced very few modified verbal formulae in average, and no significant difference was found between the two verbal groups (t=0.777, p=.440>.05), see **Figure 5.5**.

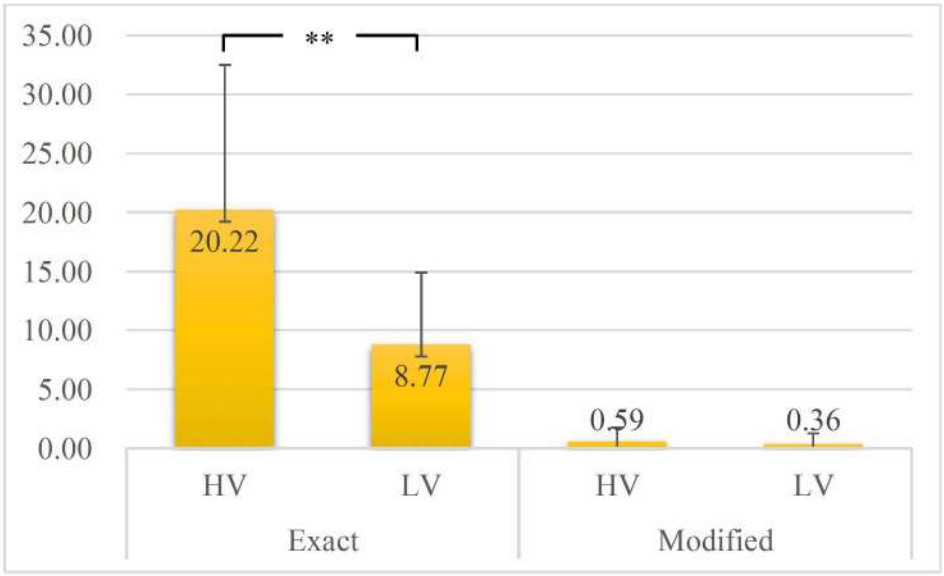

Figure 5.5 Average exact and modified formulae produced by high-verbal (HV) vs. low-verbal (LV) children with ASD

The production of modified formulae requires substantial complex processing stages and costs more effort. Children with ASD who produced modified formulae need to know how to combine the formulaic structures with the additional elements as a complete sentence or more complicated phrase segments. Alternatively, they need to know how to insert or omit new lexical elements grammatically. Such production of modified formulae requires the ability of creativity. However, both the high-verbal and low-verbal children with ASD in this study showed low a level of creativity in the production of formulaic occurrences.

In sum, the production of formulaic occurrences, their related relevance, complexity, and creativity varies between high-verbal and low-verbal ASD children. The findings reveal the great importance of verbal ability in the production of formulaic language by children with ASD, something that had been ignored in prior autism language research.

5.4 Discussion

This section discusses significant findings based on the quantitative analysis of formula production in 63 Chinese children with ASD in this study. The positive correlation between the production of formulaic occurrences and general language ability in ASD reveals the role of formulae in language development. The comparisons on the performance of different types of formulae between high-verbal and low-verbal children with ASD further confirm the important role of formulae in autism child

language acquisition. This section includes two subsections, discussing the importance of formulae in language acquisition and lexicon development.

5.4.1 The use of formulae as an acquisition strategy

This study explores the prevalence of verbal formulae in autism speech and compares the production of formulae between ASD children with high-verbal and low-verbal abilities. The quantitative data show that the children with ASD produced a high proportion of entrenched formulaic expressions. Most of these formulae were relevant to the target images or their associative socio-cultural or socio-communicative rituals. The formulae produced by the high-verbal and low-verbal children with ASD in this study vary in the average and total amounts of formulae. Their performances of the relevance, complexity, and creativity of formulae also differ between the two ASD groups. The frequent production of relevant prefabricated expressions supports the idea that formulaic sequences may be used as strategies in ASD conversation. Furthermore, the results on the high production of isolated and exact formulae compared with lower percentages of embedded and mitigated formulae seem to indicate that regular sentence fragments are also stored in the mental lexicon in addition to complete sentences. Examples are phrases retrieved as fixed units (e.g., 睡觉, “Go to sleep”), complete sentences known as such to the community (e.g., 我们都有一个家，名字叫中国！ “We all have a family named China”), fixed socio-cultural (周末愉快！“Have a nice weekend!”) and socio-communicative expressions (e.g., 一会儿见！“See you later!”).

In addition, the results also throw light on first language acquisition more generally. The full extent to which first language acquisition involves formulaic sequences is still unclear, although evidence for a substantial role of it has been put forward (Nelson 1973; Plunkett 1991; Lieven et al. 1992; Hickey 1993; as reviewed in Chapter 2). Researchers reported two predominant styles of acquisition in the language development of typically developing children, frequently described as *analytic* (or 'productive') and *holistic* (or 'gestalt') styles (e.g., Nelson 1981; Bretherton et al. 1983; Peters 1983; Bates et al. 1988). The former style, analytic, is one in which children acquire more complex language by combining single elements to multi-word units based on productive or generative rules. By contrast, a holistic style of acquisition is when children utter under-analyzed language forms or chunks without paying attention to their internal structure or specific meaning of single lexical elements (e.g., Clark 1974; Peters 1983). All children probably use processes of part to whole or whole to part in different aspects of language acquisition (e.g., Peters 1977; Tomasello & Brooks 1999: 166).

The formulae data in this study further support the idea that the production of formulaic occurrences, mostly under-analyzed chunks that are holistically acquired, can also be regarded as an acquisition strategy or an alternative path to language development used by children with ASD. Additionally, the frequent use of formulaic language in autism speech indicates a holistic processing model in atypical child language acquisition. However, ASD children also produce referential nouns or descriptive statements, revealing a balanced and combined way involving two

processing models. Thus, this integrated model of analytic and holistic processing is applicable not only to typically developing children, but also for children diagnosed with ASD. The use of widely recognized formulae helps the interlocutor understand that children with ASD are able to share the same conversation frame with interlocutors in the speech community. This finding further supports the idea in Lieven et al. (1992) that the acquisition of frozen phrases may provide an alternative route into multi-word speech. The practical use of formulae in children with ASD seems to be consistent with the role formula plays in typical child language acquisition (Nelson 1973; Plunkett 1991; Lieven et al. 1992; Hickey 1993; Wray & Perkins 2000; as demonstrated in Chapter 2). However, the findings are against the linguistic 'dead-end' view in Bates et al. (1988). The 'dead-end' view regards the acquisition of formulaic chunks or frozen phrases stops further linguistic development in children. This contrasts with what the data showed in the current study, in which strong positive correlations were found between the use of formulaic language and general language ability (i.e., expressive vocabulary size and the command of grammatical categories). Thus, children with ASD seem to use formulaic occurrences as a roundabout way to help with their language development.

5.4.2 The role of formulae in the lexicon

The significant correlations between the production of verbal formulae and expressive vocabulary as well as grammatical ability indicate that the development of formulaic lexicon and grammatical lexicon do not conflict. Instead, they interact with each other,

which is contrary to the idea that verbal formulae in autism speech are indicators of poor language skills or stereotyped speech. This probably indicates that different lexicons in people's minds promote each other's development, and there are close connections between each lexicon. Thus, the use of formulae and the development of expressive vocabulary collaborate. At least at the interactional level on children with ASD, formulae help them interact with the interlocutor so as to reach specific communicative goals in social conversations.

Wray (2002: 262-263) proposed a distributed lexicon model in order to analyze the relationships between formulaicity and five different lexicons (i.e., grammatical lexicon, referential lexicon, interactional lexicon, memorized lexicon, and reflexive lexicon). What Wray calls Lexicon I, i.e., grammatical lexicon, mainly consists of prepositions, conjunctions, classifiers (e.g., *because*, *unless*). Lexicon II, i.e., referential lexicon, simply includes word strings and morphemes (e.g., *give NP to NP*, *unhappy*). Lexicon III, i.e., interactional lexicon or routines, mainly includes formulaic word strings that are frequently used in social communication (e.g., *Great to see you!*), and lexicon IV, i.e., memorized lexicon, referring that strings of words are stored and processed holistically (e.g., *nursery rhymes*). Lexicon V, i.e., reflexive lexicon, in which formulaic language makes a half percentage, and another half involves bound or free morphemes, such as *goodness* or *shit*. For instance, *take it slowly*! might be stored holistically in Lexicon III, *take* and *slow* in Lexicon II, and *it* and *-ly* in Lexicon I. The formulaic phrase contains lexical elements from different lexicons, so it could be created by rules, and it could also be stored holistically as an idiomatic expression.

Among these five lexicons defined by Wray (2002), all lexicons involve formulaic language but with different proportional distributions. However, the interactional lexicon and memorized lexicon mainly consist of formulaic word strings, referring to the fused forms or fixed chunks that are holistic in nature, require little processing attention, and save precious processing effort compared with novel constructions. Formulaic chunks are stored and retrieved as wholes in long-term memory, so formulae seem to be more accessible when being retrieved from the interactional or memorized lexicons, compared with the retrieval of common nouns from the grammatical and referential lexicons. Examples are singing the memorized birthday song to refer to a cake and pretending to answer a phone call with a formulaic expression 喂，你好！ "Hi, how are you?" to name a telephone.

In this study, the children with ASD produced a high proportion of formulaic sequences that were appropriately used in different contexts. It seems that there is a *formulaic lexicon* in the mind of ASD children, since they even use verbal formulae that are embedded with common nouns to name the referent. Alternatively, it is also possible that the associations between formulaic expressions and the target referents are closer than that with corresponding nouns. For example, children produce *"Go to the toilet"* for 'toilet', instead of directly answering the exact noun 'toilet' when asked to name it. In this example, 'toilet' belongs to the referential lexicon, while *"Go to the toilet"* should be included in the interactional (routine) lexicon. The formulaic use of socio-communicative linguistic units supports that in the mind of children with ASD, the formulaic lexicon contributes a lot when retrieving word strings from the lexicon

to reach the communicative goals or manage the conversation. Thus, the integrated model of the distribution of different lexicons, particularly the interactional (routine) lexicon and the memorized lexicon, helps explain the frequent production of formulae in autism speech.

Furthermore, formulae preceding correct nouns produced as responses to name the referent suggests that some children with ASD might produce formulae easier and faster than common nouns. Formulae in general, might be stored in memory with their verbal experience in related social rituals, communicative scenes. This might be because the storage and process of formulae are more accessible than that of referential nouns for children with ASD, since using formulae seems to require less effort for them, as suggested by the findings on formula research in adult language use (see Chapter 2).

In conclusion, the participants in this study produced a large proportion of formulaic language, most of the produced formulae being relevant to the target entities or individuals in the elicitation task. In addition, the significant correlation between formula production and general language ability was confirmed, and there were significant differences in the performance of formulae between the high-verbal ad low-verbal ASD children. This shows that acquiring formulae earlier seems to help children with ASD develop better vocabulary and grammar later. Another possible interpretation of the finding might be that better vocabulary and grammar development help ASD children make better use of limited language knowledge they acquired, by retrieving formulae with less effort.

5.5 Summary

This study focused on the production of verbal formulae in children with ASD. It first examined the relation between the production of formulae and general language ability in children with ASD, including expressive vocabulary size and competence in using grammatical categories. Then this study compared the performance of the produced formulae varying in average amounts, percentages, relevance, complexity, and creativity between high-verbal vs. low-verbal ASD children.

The main findings of this formula study are: 1) Formula production closely correlated with the expressive vocabulary and the command of grammatical categories assessed via the Putonghua Communicative Development Inventory (PCDI), which indicates the positive role of general language ability on formula production in autism speech; 2) Most of the formulae produced by children with ASD were closely relevant to the target referents or their verbal experiences in related associative socio-cultural or socio-communicative situations; and 3) High-verbal ASD children produced a significantly higher proportion of formulaic sequences that are relevant to the referents or associated with related rituals than the low-verbal group. The differences in the production of formulaic occurrences reveal the significance of verbal abilities in the use of formulae, thus indicating that general language ability has an impact on the ASD children's pragmatic performance in conversation.

These findings confirm the hypotheses put forward in the first section, and are consistent with what has been found in prior research on formulaic language in typical child language acquisition (Nelson 1973; Plunkett 1991; Lieven et al. 1992; Hickey

1993; Wray & Perkins 2000). The high proportional production of formulae in autism speech indicates the importance of formulae in both typical and atypical child language acquisition. In addition, most formulae produced by the participants were relevant to the target materials, showing that producing formulae might be an easier way for children with ASD to refer to some objects or individuals when they failed to retrieve the proper lexicon from memory to answer questions, or to maintain conversations when they don't know the answers. The positive correlation between formula production and general language ability of children with ASD and the significant differences between the two verbal groups support the idea that language ability impacts the use of formulaic language or the production of formulae might help with language development in ASD.

This is the first time research on formulaic language as such in autism speech, particularly in Chinese children with ASD. This study expands our knowledge of the prevalence and importance of formulaic sequences in autism speech. The findings also help better understand the relation between ASD children's pragmatic performance and general language ability (i.e., vocabulary and grammar). Thus, this sheds light on the important role of verbal abilities in using communicative phenomenon by ASD. This finding indicates that verbal formulae might be an acquisition strategy in language development, revealing its importance in the lexicon for ASD children. The significant role of formulae in autism language development is similar to that of typically developing children, which shows that children with ASD share some developmental characteristics or patterns with typically developing children.

This study fills a gap in the research of formulae in autism language development, and also remediates the lack of explorations on pragmatic phenomena in autism language research. Theoretically, the quantitative analysis on the production of formulae by Chinese children with ASD supports the usage-based perspective on child language acquisition, the strategical role in ASD language development, and the integrated model of formulaic lexicon. Clinically, the elicitation materials that were carefully selected and designed, could be directly used as scientific tools for language assessment of children with ASD, thus helping with their language development and the treatment of their communication difficulties. This study calls for more research from linguistics, psycholinguistics, or cognitive science, to systematically explore the essential role of verbal formulae in language development of Chinese pre-school children with ASD.

Chapter 6 Conclusions

This chapter first summarizes the main findings of the qualitative study on functional echolalia by 8 Chinese children with ASD (Chapter 4) and the quantitative study on formula production in autism speech of 63 ASD children (Chapter 5). Then, the theoretical and clinical contributions are presented. Particularly, the theoretical implications are discussed from the perspectives of fictive interaction theory (Pascual 2006, 2014; Pascual & Sandler 2016), the usage-based theory of child language acquisition (Tomasello 1992, 1999, 2002, 2003; Lieven & Tomasello 2008), and the integrated model of lexicon involving formulaic language (Wray 1999, 2002, 2008; Wray & Perkins 2000). Last, some limitations of this dissertation are mentioned, and I also lay out a few suggestions for future research on autism research.

6.1 Major findings

The main findings of study 1 (Chapter 4) help integrate the types and functions of echolalia used by Chinese children with ASD, and study 2 (Chapter 5) reveals the frequent production of verbal formulae and suggests its positive role in language development for ASD children.

On the first research question of study 1 (i.e., Is the echolalia functional or pathological?), the results support the idea that echolalia, as the typical characteristic of autism speech, is mostly functionally used in the speech of Chinese children with ASD. As for the second research question of study 1 (i.e., How do children with ASD

manage to answer simple questions or maintain a conversation by using echolalia functionally?), the results demonstrate some functions of echolalia relating to different entities or professions from different scenarios or aspects of life (shopping, hospital visit, restaurant, etc.). The 5 specific functions are: naming, description, topic development, or used as conversation or cognitive strategy. In study 2, widely recognized formulae, as the main source of echolalia, are frequently produced by Chinese children with ASD. The answer for the first research question of study 2 on the relation between formula production and general language ability is that they are positively correlated. Concerning the second research question of study 2 (i.e., Are there any differences in the performance of formula production between ASD children with high-verbal vs. low-verbal abilities?), the findings reveal great heterogeneity in the production of formulae from the perspectives of average amount and percentage, relevance, complexity, and creativity of formulae between high-verbal vs. low-verbal ASD children.

Study 1 examined the functional complexity of echolalia produced by 8 children with ASD. As presented in Chapter 4, the study on functional echolalia compared the production of echolalia vs. corresponding nouns in the naming task, and the production of echolalia vs. statements in the description task. Additionally, study 1 explored the specific functions of echolalia in different ritualized conversation scenarios. In study 1, Chinese children with ASD produced a lot of delayed echolalia with different specific functions. The echolalic utterances produced by ASD children show complex functions to remediate their disorders in social interaction. In order to reach the interactional

goals, children with ASD seem to use functional echolalia to help them make use of limited linguistic knowledge to communicate. In some cases, the ASD children in study 1 showed an ability to shift perspectives when echoing the speech of others to play the role of speakers or hearers in previously-encountered conversation frames. The children with ASD in study 1 also produced echolalia embedded with target nouns, instead of directly providing the target common nouns. This indicates the important role of echolalia in conversation for autism.

The main findings of study 1 on echolalia are: 1) The children with ASD produced both delayed and immediate echolalia, but more delayed echolalia than immediate echolalia. Delayed echolalia was oriented to answer the test questions; the ASD children functionally used delayed echolalia to name the target entity or individual, in which echolalia showed referential functions. The participants also used immediate echolalia to manage the conversation or help themselves think; 2) In the elicitation experiment, the children with ASD produced a lower percentage of echolalia than corresponding nouns, but a higher proportion of echolalia than statements in the description task. This reveals that ASD children tend to produce echolalia, as an alternative route to help them reach the communicative goal when they fail to retrieve the corresponding nouns from their long-term memory; 3) A majority of echolalia produced by the participants were functional; in addition to 'naming', some other specific functions are concluded based on the analysis of prototypical examples (i.e., description, topic development, conversation management strategy, and cognitive strategy). Still, there were some semi-functional (i.e., free association) and non-

functional echolalia (i.e., meaningless repetitions), but making up a very low percentage.

The findings of study 1 thus help integrate two models of the types and functions of echolalia, which was concluded from the qualitative analysis of prototypical examples involving echolalia in study 1 (presented in Chapter 4). This might help both autism therapists and parents better assess the pragmatic performance of Chinese ASD children, and finally help with their difficulties in interaction and communication. First, parents or therapists need to answer the question: Does the child produce repetition? (i.e., source, time span, complexity, and creativity; see **Figure 6.1**) If yes, does the repetition relate to the topic involved in the ongoing conversation? (i.e., level of relevance between echolalic instance and the target referent; see **Figure 6.2**).

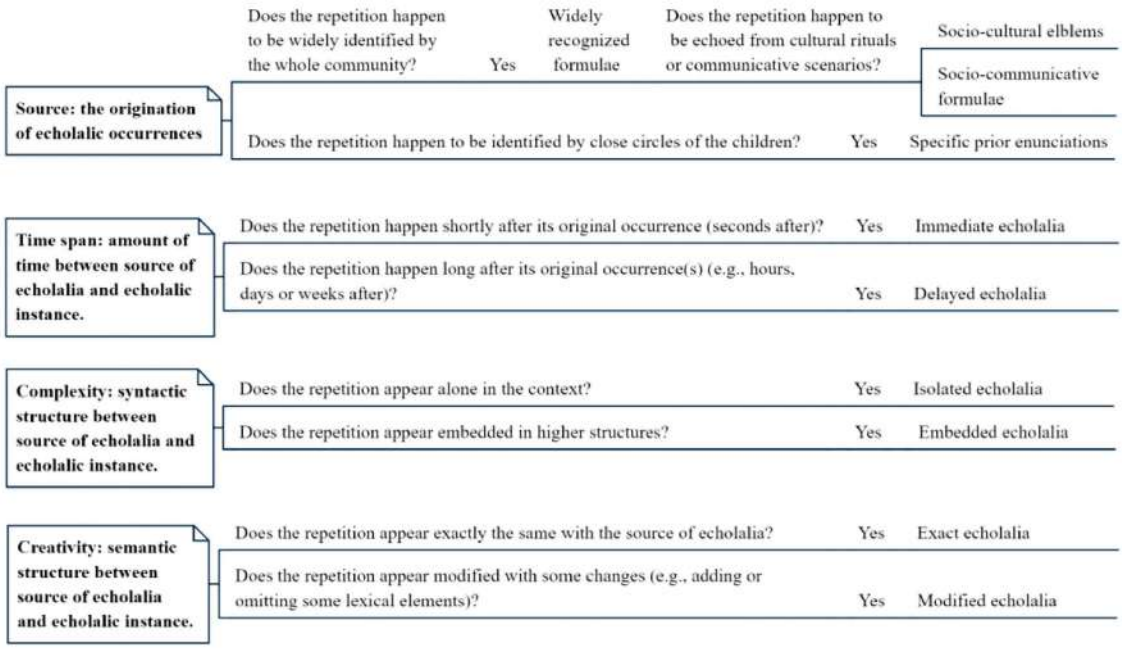

Figure 6.1 Integrated model of the types of echolalia in children with ASD

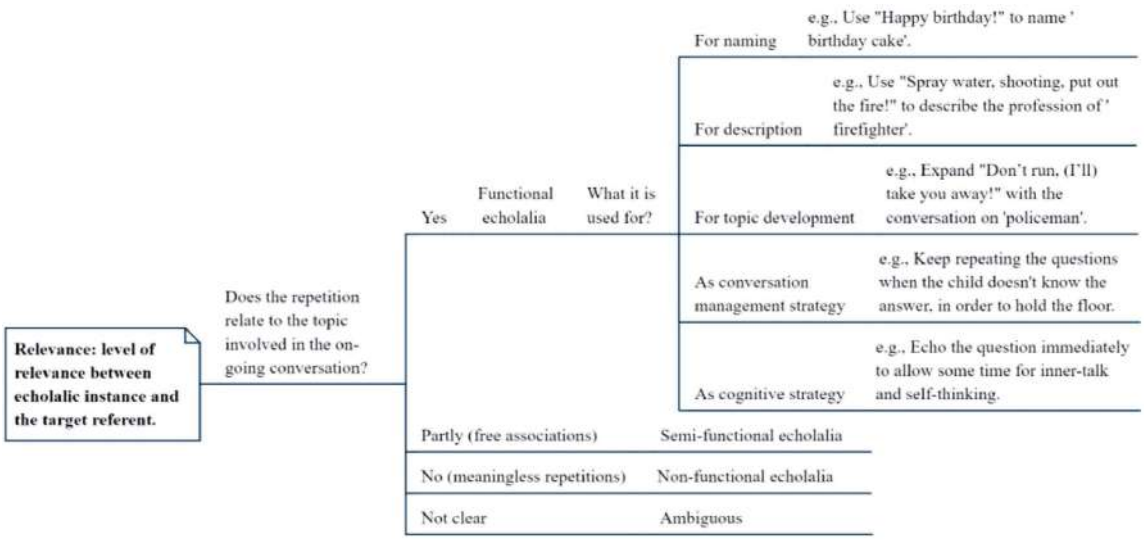

Figure 6.2 Integrated model of the functions of echolalia in children with ASD

Regarding the sources of echolalia, a high proportion of echolalia produced by the children with ASD were widely recognized formulae that could be identified by the wide community. This calls for more attention on the explorations of such widely identified formulae (i.e., socio-cultural and socio-communicative formulae) in autism language research, as explored in study 2, which may help better understand the developmental patterns of formulaic language in autism speech.

Study 2 explored the production of formulae relating to ritualized situation by 63 children with ASD, focusing on socio-cultural emblems and socio-communicative formulae. The quantitative analysis examined the relation between formula production and the participants' general language ability, and compared different performances of formulae produced by the high-verbal (n=41) and low-verbal (n=22) ASD children that undertook the task. The frequent production of verbal formulae and the positive correlation with general language ability reveal the important role of formulae in autism language development. Particularly, it might be an acquisition strategy for children with

ASD, and verbal formulae seem to form the salient part of the lexicon in their long-term memory.

Specifically, the main findings of study 2 on formula production include: 1) Positive correlations were found between the ASD children's formula production and their expressive vocabulary size, as well as their command of grammatical categories. This seems to show that producing formulaic language is a good indicator or a sign of vocabulary development for ASD, similar to typical child language acquisition; 2) The high-verbal children with ASD produced significantly more formulae than the low-verbal group. This finding confirms that the ability to use formulae is not contradictory with the development of vocabulary and grammar in autism speech; 3) Concerning the relevance of formulaic expressions produced by the participants, most formulae were related to the target referents or associative situations. This reveals that children with ASD closely associate verbal formulae with related conversation scenarios, and might store them together in their long-term memory.

Combining the qualitative analysis of complex functions of echolalia with the quantitative data on formula production and its relation with general language ability, the findings of this dissertation help reveal the important role of echolalia and the developmental patterns of formulae in autism speech. Hence, echolalia may not simply be stereotyped but may instead be a strategy in autism language use. Echolalia shows at least five specific functions in the speech of Chinese children with ASD. They tend to use echolalia to communicate functionally, with the limited language resources they have, in a similar way as individuals suffering from aphasia do (McElduff &

Drummond 1991; Oelschlaeger & Damico 1998; Győrfi 2017). The functional usages of echolalia seem to show that children with ASD can easily associate given formulae they echo from previous verbal experiences. Also, the associations between formulae and the target referents might be easier than common nouns with the referents. Echolalia and verbal formulae can be regarded as an adaptation strategy in pathological language acquisition in the case of Chinese children with ASD. Thus, echolalia and formulae seem to be significant moderators for the development of expressive language and communication in autism speech.

6.2 Theoretical and practical implications

The research presented in this dissertation is theoretically and clinically significant. First, the functional usages of echolalia by Chinese children with ASD support the idea that echolalia is mostly functional in autism speech, instead of a pathological default that should be avoided. Echolalia seems to be a roundabout way for children with ASD to reach their interactional goals. Thus, it should be regarded more positively, or as Sterponi (2014) suggests, one should re-think the definition of echolalia. Second, the positive correlation between formula production and language ability sheds light on the usage-based theory and lexicon development in language acquisition. Clinically, by helping to answer the question on how children with ASD use their limited language knowledge to overcome their communication disorders by using echolalia, this research helps to build two models on the types and functions of echolalic instances, so as to help with the assessment and treatment. The models may help researchers,

clinicians, and parents to understand autism speech further and finally reach the ultimate goal of overcoming the difficulties in social interaction.

6.2.1 Theoretical implications

Prior research on children with ASD has mostly explored these children's behavior or cognition, or narrowly focused on the structural aspects of language (e.g., phonology, semantics, syntax) instead of social functions or pragmatic performance (as presented in Chapter 2). A contrast between linguistic competence vs. performance and a dissociation between lexical and grammatical domains is agreed by most researchers (Tager-Flusberg 1994:198, 2005:188; Su & Naigles 2019, 2021, 2022). However, deficits in social interaction or communication have been widely acknowledged as typical of diagnostic disorder for ASD, but barely investigated. How they use such communicative phenomena (i.e., echolalia and formulae) is still largely unknown.

In the light of this, the research offers more evidence for the connections between lexical ability and pragmatic functioning in the speech of Chinese children with ASD, instead of the 'dissociation' reported in English ASD children (Tager-Flusberg 1994:198, 2005:188). Specifically, the ASD children's expressive vocabulary and the competence in using grammatical categories were positively correlated with the production of formulae and their relevance. The positive correlations indicate a close relation between pragmatic performance and lexical competence, and the command of grammatical categories in children with ASD, revealing a new picture for language research in autism speech.

Additionally, this research focuses on how ASD children manage to communicate with their limited language resources by echoing formulaic expressions or utterances they heard before. Such echolalic occurrences may be fixed linguistic units that are widely known to the entire speech community (i.e., socio-cultural emblems and socio-communicative formulae) or specific prior enunciations that only the children's close circle can identify. This research closely connects these two communicative phenomena (i.e., echolalia and formulae), further expanding our understanding of echolalia in autism speech. While formulae have been widely studied in typical child language, and regarded as acquisition aid or processing short-cut for typically developing children, researchers ignored that formulae, as the main source of echolalia, could also be an indicator of language development in children with ASD.

(a) The use of verbatim fictive speech as a strategy in ASD conversation

Theoretically, this research sheds light on the theory of fictive interaction (Pascual 2002, 2006b, 2014; Pascual & Sandler 2016; Pascual & Oakley 2017). As introduced in Chapter 1, functional delayed echolalia may be defined as a kind of verbatim fictive speech (e.g., "*I do*" ring refers to 'marriage ring', here "*I do*" constitutes an instance of fictive speech) repeated from prior verbal experiences, instead of being created spontaneously in the context of the ongoing conversation. For example, one child may echo a frequently heard enunciation, "Drink some water!" as a way to name the glass in the conversation, instead of this being used as an actual command as in the source. Fictive interaction may be used to gain mental access to events, actions, and states in

the here-and-now, which often happens in adult speech for humorous and/or persuasive purposes (see Pascual 2014, Pascual & Sandler 2016 for an overview; Fonseca et al. 2020). Fictive interaction emerges in language pathology (e.g., aphasia, autism), helping structure cognition, the conceptualization of reality as conversational, discourse organization, language structure and use (Pascual 2002, 2006b, 2014; Xiang et al. forth).

In autism speech, fictive interaction, specifically so-called verbatim fictive speech, becomes manifest as functional delayed echolalia, which can be regarded as an adaptation strategy in conversation (Dornelas & Pascual 2016). The echoed fictive speech seems to help children with ASD build associations or make mental contact with the verbal experiences they encountered in the past, and also helps them inner think or manage the conversation. As presented in Chapter 1, the examples reflecting self-think or inner-talk support the idea that thought is an inner conversation (Mead [1934] 1955; Uhr 1973; Dennett 1996; Pang 2005; Pascual 2008, 2014).

Additionally, fictive interaction involves shifting different perspectives (Pascual 2006, 2014; Jarque & Pascual 2016), and children with ASD showed the ability of perspective-shifting in this research, by using verbatim fictive speech strategically in conversation. As discussed in Chapter 4, one child enacted himself as a deliveryman first by saying, “Here are your parcels”, then shifting his perspective to the customer with a verbatim formula “Thank you”. Here, the child builds a scenario with deliveryman and quotes verbatim fictive speech by re-enacting prior speech from past experiences to ongoing interaction to compensate for their difficulties in social

communication in the here-and-now. The functional usages of echolalia in this research's elicitation data support the idea that fictive uses of formulae role as an adaptive strategy for ASD children in conversation. Thus, children with ASD use fictive quotes to make mental contact with previous communicative situations, using the verbatim fictive speech (i.e., echolalia) as a way to structure their inner thoughts, conceptualization, and discourse organization, and finally helping with communication.

(b) Usage-based perspective of autism language acquisition

As suggested by Cruttenden (1981), formulaicity plays a central role in the early stages of language acquisition of typically developing children. Formulaic sequences are reported to play an essential role in the early interaction stage as a processing shortcut or acquisitional aid in language development (e.g., Wray & Perkins 2000; Wray 2002; Wray & Namba 2003). It seems that children with ASD retrieve verbal formulae that are closely related to given objects or individuals or associative conversation frames in different contexts, which is consistent with the view in child language acquisition that learning happens by using, so-called the perspective of usage-based approach (e.g., Tomasello 1992, 2002, 2003; Barlow & Kemmer 2000; Tomasello 2002; Diessel 2004; Tummers et al. 2005). A usage-based perspective on child language acquisition supports the idea that language construction emerges from language use (Tomasello 2000; Lieven & Tomasello 2008). Young children develop language in a way that formulaic language constitutes a significant portion (Lieven et al. 1992). Formulaic chunks were widely produced by the children with ASD in this research, most of which

appear to be highly fixed in construction and used as appropriately in the ongoing conversation. Such broad use of verbal formulae in related ritualized situations in autism speech thus supports the usage-based perspective on atypical child language acquisition.

The usage-based perspective on child language acquisition (Bybee & Scheibman 1999; Tomasello 2000) argues that learning happens by using. A usage-based theory explicitly states that typically developing children learn and use many relatively entrenched item-based linguistic expressions that are stored and produced as single fixed linguistic units (e.g., 晚安, "Good night"; 打电话, "Make a phone call"). The frequent production of formulae and its functional usages in conversation in autism speech thus show that the usage-based theory should also apply for autism child language acquisition.

Children at a young age learn what they hear, and different children naturally hear different things in different quantities. The acquisition of language is not just triggered by the linguistic environment but rather the raw materials provided by the linguistic environment. Young children construct their linguistic inventories in this way. Under such perspectives of cognitive-functional and usage-based theories on child language acquisition, the importance of frequency and repetition is revealed. That is, the majority of the utterances that ASD children hear are grounded in relatively isolated, item-based constructional frames that children with ASD have experienced many times every day.

(c) The use of verbal formulae as lexical retrieval strategy

In child language development, most typically developing children can quickly move through the stage of holophrases (i.e., a single-word phrase such as *Okay* that expresses a complete, meaningful thought) or one-word sentence (e.g., saying *Dada* meaning "Daddy, please come to me") and develop to the two-word (e.g., *Doggy big*, declarative; *Where ball*, interrogative; *Not egg*, negative; *More sugar!*, imperative) or multi-word stages (e.g., *Doggy is big*, *Where is the ball?*, *That is not an egg*, *I want more sugar*). Still, some children need an 'intermediate' phase, in which they produce memorized chunks or verbal formulae before acquiring word combinations, especially in the case of children with ASD.

Some children with ASD in this research first produced related formulae associated with the target materials or related conversation situations, and then answered the corresponding nouns of the referents. Such examples offer evidence for the role of lexical retrieval strategy that formula plays in conversation. For example, children first sang the memorized song they remembered in the socio-cultural ritual of a birthday party when looking at a birthday cake the first time. After producing the formulaic chants, children successfully retrieved the correct noun 'birthday cake'. In another conversation involving the target stimuli 'glass', one child first uttered a verbal formula "Drink (some) water" and repeated it a second time when being asked to name the referent. After two times of repetition with the formula, the child finally retrieved the corresponding noun 茶杯, "Teacup".[8] In such situations, the ritualized formulae

[8] A teacup is usually small enough to be grasped with the thumb and one or more fingers, used for

helped ASD children memorize or retrieve the common noun of the target image from their long-term memory. Such examples reveal the important role of the formulae as a linguistic retrieval strategy for children with ASD.

Thus, ignoring formulaic language in autism speech would achieve little, since this developmental phase lasts longer in children with ASD than in typically developing children. This means that older typically developing children may have developed to multi-word stages, but ASD children matched with normal controls in chronological age may still stop at the formulaic stage, and keep using formulae strategically in communication. Instead, helping them make use of formulae as a lexical retrieval strategy and apply it appropriately in conversation is probably more efficient and effective.

Furthermore, since several echolalic formulae were produced before the experimenter's question, the participants evidently had forged a strong link between what was represented in the image and their verbal experiences with that referent. This sheds light on how concepts are 'stored' in people's minds. People clearly not only store the names of concepts (e.g., 'marriage ring', 'soccer ball'), individuals' perceptual experience with them (material, shape, carat/size), and simulations of embodied interactions with them (propose to the beloved girl; kick the ball) (Barsalou 1999; Glenberg & Kaschak 2002; Bergen & Feldman 2008), but also verbal experiences socio-culturally associated with them (saying "*Marry me*" or "*I do*"; *Gooal!!*).[9] Indeed,

drinking tea, while a glass is usually used to drink water. Here the answer 'teacup' is regarded as the right answer which shares the same category with 'glass'.

[9] This idea is cited from the manuscript "Functional echolalia in autism speech: Verbal formulae and

the data reveal that children with ASD store whole social scenes related to the target objects, with interjected verbal formulae forming a salient part of them. The fact that children with ASD so often associate the target images with entrenched linguistic units commonly related to them in the linguistic community shows that they are good with both association and metonymy. Their anticipating the experimenter's questions also seems to indicate that autism may not be a disorder of prediction, as has been suggested (Sinha et al. 2014), or not too severely or at all levels.

Additionally, Wray (2002:263)'s classification of the integrated model containing five lexicons,[10] in which formulaic expressions are included, in fact supports the idea that children acquire and store lexical terms in different ways. It seems that the cognitive load is much lighter for children with ASD when storing and retrieving formulae in their long-term memory than the corresponding nouns in the referential or grammatical lexicons. One important approach for ASD children is to remember the verbal formulae associated with the target referents in their integrated lexicon stored in experienced conversation scenarios, and retrieve them as a whole when in use.

This research thus combines language and cognition theories, bridging the gap between core grammatical studies and modern conversation and discourse analysis in autism language research. This research may also inform the development of therapy tools and diagnostic protocols, and more comprehensive language assessment for

repeated prior utterances as communicative and cognitive strategies" (in preparation), written together with Esther Pascual and Todd Oakley.

[10] The five lexicons are: grammatical lexicon, referential lexicon, interactional lexicon, memorized lexicon, and reflexive lexicon.

children with ASD, particularly for Chinese preschool children with ASD.

6.2.2 Clinical implications and social value

This research has both social value and clinical significance. In the 30th anniversary of the China Welfare Fund for the Handicapped in 2014, Chinese President Xi Jinping emphasized that the country, the public, and the society should specifically pay more attention to people with disabilities and disorders. President Xi also proposed that“广大科技工作者要把论文写在祖国的大地上”(‘*Researchers should conduct research to meet the needs of the motherland*’) at the National Conference on Science and Technology Innovation in 2016. This is particularly important and urgent in the case of children with ASD, since there is a dramatic and gradual rise in the preliminary prevalence of autism in mainland China, as stated in Chapter 1. More studies on the specific characteristics of language and cognition in Mandarin-speaking children with ASD are desperately needed to address the language and communication problems of this atypical group.

The findings of this research could be viewed as evidence for the effectiveness of echolalic formulae used as cognitive or communicative strategy by children with ASD, rather than them constituting instances of purely stereotyped and repetitive speech to be avoided. Despite the fact that echolalia is used for diagnosis, this raises new insight and offers important implications for clinicians regarding how to design more scientific intervention programs for verbal ASD children who produce formulae in general. For children with ASD who are minimally verbal or even non-verbal, therapists or parents

may also learn from the models of echolalia to interact with ASD children in their way. The functional usages of formulae should be viewed from a cognitive-pragmatic or usage-based perspective, instead of a pathological default arising from the comparison with typical child language development. Thus, the findings shed some light on formulae as an intervention strategy by children with ASD to make up for their language deficits and communicative difficulties.

This research is clinically relevant, as it may help in language assessment and communication treatment for ASD. Most of current language assessment inventories can only evaluate the lexical, grammatical, or semantic skills of children with ASD. At the same time, pragmatic performance, a significant index for diagnosis, has been ignored. Thus, since the measures on interactional abilities of ASD children have not been included in standard tests, there is a lack of tests including the valuation of children's pragmatic performance or longitudinal evaluations on interactional abilities after a period of language rehabilitation. It should be pointed out that the pragmatic abilities are not purposely ignored, but inevitably dismissed due to the great difficulty in assessing ASD children's pragmatic performance via objective standard tests. The integrated models of the types and functions of echolalia produced by Chinese children with ASD might help design tests for language assessment, which might be used by language pathologists and caregivers directly.

The visual stimuli and protocol designed and used in this research might be available for testing children's interactional ability or communicative performance. Specifically, the final 24 test stimuli concepts and related images were designed very

carefully (as presented in Chapter 3), and should be widely familiar to all or most pre-school children with ASD who speak Mandarin. The materials can elicit a lot of verbal formulae related to social scenarios that are familiar to preschool ASD children. Thus, the dataset collected in this research and the built-up elicitation tool might help build a more comprehensive language evaluation protocol in autism assessment to evaluate the ability to use formulae in children with ASD, especially Chinese-speaking ones. This also offers an effective elicitation protocol for future quantitative studies on partial or verbatim repetitions by children with ASD and testing individuals with other language pathologies involving echolalia (e.g., aphasia, schizophrenia, semantic dementia).

With this research, I hope to offer scientific directions for speech-language pathologists in Chinese autism rehabilitation centers and thereby help children with ASD to communicate. Moreover, the increasing number of studies on ASD language research in China would finally attract more attention from the international community, which may lead to more emphasis on the explorations of pragmatic functions in the speech of Chinese children with ASD. Additionally, the findings of this research would also be relevant worldwide and offer general evidence for further investigations on pragmatic phenomena in ASD children speaking different languages in the world.

As for the implication for caregivers of autism children, this research may help parents further understand autism speech, and calls for more patience when interacting with their children. For example, parents should try to accept the fact that children with ASD produce echolalia to help themselves think, interact or manage the conversation. Thus, not correcting their echolalic or formulaic productions is a good way to give

positive feedback to them and increases their willingness to interact with people. Finally, this may help with the scientific intervention of early language and communicative difficulties in children with ASD, achieving language rehabilitation in social conversation, and eventually facilitating a more efficient approach for treatment.

6.3 Limitations and avenues for future research

This dissertation contains two studies exploring two communicative phenomena that are closely related (i.e., echolalia and formulae) in Mandarin-speaking pre-school children with ASD. Despite the significant findings summarized and the contributions discussed above, this research has a few limitations. Future studies should conduct more research on the pragmatic performance of children with ASD, focusing on their processing or longitudinal aspects. The implications of the results presented in this dissertation should be expanded to inspire innovative ideas in future autism language research.

6.3.1 Limitations

It is not easy to study pragmatic phenomena quantitatively, and it's also hard to conduct language research with ASD children, who have difficulties in communication. Thus, for study 1 on the functional usages of echolalia, the participants were relatively small. This may challenge the generalizability of the conclusions to autism speech for ASD when this group is reported to have great heterogeneity. As a compensatory strategy, both qualitative and quantitative studies were conducted in this dissertation, exploring

two crossed communicative phenomena (i.e., echolalia and formulae), so study 2 on the production of formulae involved a larger sample size (63 children with ASD). Yet, there are still some limitations.

Concerning the research methodology, no control group (e.g., children with other language disorders, vocabulary-matched typically developing children, or typically developing children matched in mental or chronological age) was recruited to compare with the ASD participants in this dissertation. In so doing, this research followed tradition in echolalic research, as adding a control group as a comparison would in fact dilute the purpose of this research. However, this may receive potential criticism from experimental psycholinguists, who generally test large populations to investigate more identifiable and interpretable phenomena (i.e., vocabulary and grammar). The concern is that having a comparison control group or groups may be a tacit acceptance of the 'pathological default' position towards echolalia, which views it as the obsessive meaningless repetition of previous speech for self-stimulating when distressed, and thus as an unfortunate phase and behavior to be discouraged. In some crucial respects, this research argues against this orientation without denying that echolalia is a useful diagnostic category and that echolalia can, on occasion, be entirely non-functional and purely self-stimulating. The focus of this research is not the comparison between neurotypicals and neurodivergents.[11]

Last, the participants recruited in study 1 were all boys and only 14 out of the 63

[11] Todd Oakley needs to be thanked for discussing this great idea during our communication on the paper "Functional echolalia in autism speech: Verbal formulae and repeated prior utterances as communicative and cognitive strategies" (in preparation), on which this chapter is based.

were girls in study 2, because of the significant deviation in the prevalence rates of ASD between boys and girls. According to the Center for Disease Control and Prevention (CDCP, 2012), the proportion of American boys with ASD is almost five times higher than that of girls with ASD (18.4‰ for boys vs. 4.0‰ for girls). Thus, there was no analysis on the gender differences in this dissertation. It was therefore not explored, for example, whether boys with ASD develop fewer or lower proficient pragmatic skills and whether they are not as good at using cognitive or communicative strategies as girls with ASD, when the general condition is matched. Also, there is an imbalance in the number of participants in the two groups in study 2, with 41 high-verbal and 22 low-verbal ASD children. The main reason is because most low verbal children with ASD are usually at an older age, but this research tests participants under 6 years old.

6.3.2 Avenues for future research

In order to deepen our understanding of the role of formulae in autism speech, comprehension studies on the processing of formulae in children with ASD are needed. The exploration on the comprehension of formulae would help answer the questions: *Do verbal formulae help lessen the processing load or shorten the cognitive distance between nominal names and referents in children with ASD?* or *Do formulae require less processing time than common nouns to refer to a referent for children with ASD?* In such processing studies, eye-tracking techniques could be applied (cf. Naigles & Tovar 2012), so that more multi-modal cues, including reaction time and interest areas,

offer combining evidence from both a production and a comprehension perspective. This would help solidify the significance of formulae in autism speech.

In addition, children with ASD speaking other languages should be recruited to examine the cross-language characteristics of functional usages of echolalia in conversation, which would help generalize the functional complexity of echolalia found in this dissertation. Quantitative studies involving a larger sample size would also help explore more general developmental patterns of formula production in autism speech.

At the same time, different elicitation materials from children's daily life should be designed, in order to elicit more prototypical examples, so that wider functions or strategies children with ASD use in interaction could be added to advance the integrated model. This would help further support the idea that formulae are not a dysfunction in autism speech, a sign of language delay, but a possible strategy for social interaction and an indicator of language development. Meanwhile, this dissertation concluded that many formulaic occurrences are related to some familiar referents. In the future, more formulae frequently produced by ASD children should be collected. Thus, together with the given data analyzed in this dissertation, a data corpus could be built to systematically assess the use of echolalia by Chinese children with ASD. Such a data-set would finally help with language therapy and improve the ability of social communications for ASD children who are echolalic. This would also help others better understand autism speech and change the way they interact with them.

Future studies should also include more factors that may impact children's pragmatic performance, in order to examine the cause-effect relations between language and cognition in ASD. There are numerous factors impacting language profile (e.g., mental age, IQ, autism level, theory of mind delay, and joint attention). Still, future studies should keep exploring the unique and universal properties, principles, and constraints in ASD individuals across languages and cultures.

Additionally, multiple measures of perceptual, cognitive, and language abilities should be used in future studies. For example, in terms of brain activity, the association between formulaic language and right hemisphere activity is tight (e.g., Springer & Deutsch 1983, Kaplan et al. 1990). Future research could investigate the neurological characteristics of processing or producing formulae in autism speech from the perspective of brain functions, particularly on the hemispheric functional differences. For example, it is reported that a dual processing model shows that the left hemisphere modulates newly created language, while the right hemisphere is responsible for the production of formulaic language (Van Lancker Sidtis 2010, 2012). Then, how is formulaic speech facilitated by the right hemisphere when novel speech is represented in the left hemisphere (cf. Heine et al. 2014)? This would help researchers better understand how formulaic speech works in the right hemisphere, which would finally help understand the relations between language and brain functions in children with ASD.

Furthermore, longitudinal studies are especially needed to find more developmental patterns in autism speech, so as to design more scientifically informed

intervention programs to advance the age of autism diagnosis. It is widely acknowledged that the level of language development of around age 5 in ASD children is highly correlated with their later rehabilitation in language and cognitive abilities (Tager-Flusberg et al. 2005), as mentioned in Chapter 1. The participants recruited for the studies in this dissertation show a delayed lexical competence compared to vocabulary-matched typically developing children, where the gap is as large as 30 months, suggesting the challenging situation. Additionally, the Chinese government, society, and researchers should pay more attention to Chinese preschool children with ASD. Future research should also try to recall caregivers' awareness and let them know the importance of seeking clinical help as soon as possible when they find the children in their care have communication difficulties.

Finally, this dissertation emphasizes the urgency of implementing scientific intervention of communicative skills in autism language research. Future studies on autism speech should pay attention to the clinical contributions and practical applications. Future studies on cognitive-pragmatic functions should involve the collaboration and interaction of various components (e.g., linguistic, biological, cognitive, and social ones, Naigles & Chin 2015). Such research with combining methods would better help ASD language rehabilitation and finally achieve successful social communication for children with ASD.