




Autistic Children's Meltdown Toy Design Requirements: Perspective from China and Malaysia

Xing Yiming¹, Natrina MP Toyong^{1*} 

¹ Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia
natrinatoy@uitm.edu.my

Abstract. There is a significant rise in the challenges faced by autistic children, particularly in the areas of social barriers and emotional behavior. These challenges impede their ability to express their emotions effectively. The research was done through interviews with educators and experts from treatment facilities, which provided evidence for increasing emotional issues in autistic children. Unfortunately, the demand contradicts the limited availability of emotionally relevant toys suitable for homes available in the market. Consequently, this study aims to examine the design criteria for emotional toys designed for home use by autistic children in both China and Malaysia

Keywords: Autistic children, Emotional human factor, Toy Design.

1 Introduction

Autism belongs to the autism spectrum factor, which occurs more often in infants and young children, mainly manifested by apparent behavioral and ability disorders, such as social disorders, developmental disorders, language disorders, and rigid hobbies and specific behaviors [1]. Autism has become the most prominent mental illness among children, and its prevalence is increasing yearly [2].

On the other hand, autism spectrum disorder is a different classification. They are characterized by a certain degree of difficulty in social interaction and behavioral thinking. Other characteristics are atypical activity and behavior patterns, such as difficulty moving from one activity to another, attention to detail, and abnormal responses to sensations. For example, children with autism are more likely to have sleep problems. Bedtime resistance, anxiety, delay in falling asleep, and daytime sleepiness may be associated with core symptoms in children with autism but not developmental levels [3]. In terms of motor behavior, autism spectrum disorder (ASD) and developmental coordination disorder (DCD) have similar behavioral and motor symptoms but are not usually studied together [4]. However, another comparative study explained the differences in lateral acceleration measured between the autism and developmental coordination groups. It showed that the behavioral and motor combination speed remained relatively slow in the autism group [4]. People with autism often have concurrent conditions such as epilepsy, depression, anxiety and attention deficit hyperactivity disorder and exhibit challenging behaviors such as difficulty

© The Author(s) 2024

R. Legino and Y. Ahmad (eds.), *Proceedings of the International Conference on Science Technology and Social Sciences – Social Science Track (ICONSTAS-SS 2023)*, Advances in Social Science, Education and Humanities Research 865,
https://doi.org/10.2991/978-2-38476-293-4_6

sleeping and self-harm. The actual level of intelligence of people with autism varies widely, from severely impaired to very high. Even studies show a higher incidence of autism in female children than male children [5].

China's level of restorative education and medical care and facilities for such people are not yet mature. The phenomenon delays the child's treatment and recovery and indirectly harms the family. In China, autism is often not diagnosed until much later in life, although features of autism can be detected in early childhood. The abilities and needs of people with autism vary and can change over time. While some people with autism can live independently, others have severe disabilities that require lifelong care and support. Autism often affects education and employment opportunities. In addition, there is a great need for family care and support. Social attitudes and the level of support provided by local and national authorities are essential factors in determining the quality of life of people with autism. Therefore, the problem of autistic children has become a severe psychological problem faced by Chinese children.

The international research on the intervention treatment of autistic children has not stopped. Across the UK, children's school experiences vary widely, but there is common ground between groups' identity formation (including bilingualism) and their classroom experiences. In one study, readers were most notable for the fact that children educated in a multilingual environment (i.e., in a school with a sizeable multilingual population) expressed more positive views of multilingualism than children educated in a monolingual environment [6]. At the same time, 2021 also suggested the feasibility of genetic research, with some results. There is a link between parents and the phenotype of children with autism, and mothers are more related than fathers [7]. The treatment of children with autism is accelerating around the world.

In the intervention treatment of autistic children in China, there are shortcomings such as primitive intervention methods, single products and long intervention cycles. At the same time, it's easy to overlook that emotional breakdowns in children with autism are likely to lead to aggressive behavior in this group. Their attacks are most likely directed at themselves, significantly harming their physical and mental health. However, there is a temporary lack of targeted and mature product solutions in the Chinese market to improve the aggressive behavior of children with autism [8]. In addition, previous research has shown that TuIs (tangible user interfaces) can help children with autism progressively complete childhood social activities [9]. However, the current social status quo is that low-tech toys for children with autism rarely use interactive interfaces to help children complete social interaction activities. Therefore, designing this type of low-tech toy is the subject of this article.

At the same time, the use of sustainable materials and design concepts should not be forgotten when designing emotionally releasing toys for children with autism. Designing sustainable toys for children with autism so they can grow together is also essential. Therefore, the research topic of the researchers is to analyze the requirements of emotional toy design for autistic children from two international perspectives: China and Malaysia.

2 Literature Review

2.1 The Importance and Feasibility of Toys for Children with Autism

Nowadays, more and more people focus on children's toys and use this as a medium to launch the treatment of autistic children. The reason for choosing children's toys as therapeutic media has been proven feasible in the studies of Deshpande and Ranavaade [11]. The theory of game therapy for autistic children's social dysfunction mainly comes from the theory of Klein and Anna of psychoanalysis school [12]. Klein's theory holds that the most natural way for children to express themselves is through play, allowing them to express their subconscious fantasies and explore and know the external world [12]. Reference [11] research also discusses the importance of games for children, and he points out that evidence-based practice may be an excellent approach to toy games. Still, not many studies use toy games to give consistent results. Later, Song Luling et al. confirmed the theory of toy play intervention. In 2018, a severely autistic child was treated with block toy play therapy, and the result proved that block play therapy was indeed effective on the social ability of autistic children [8]. The effectiveness of a similar toy intervention experiment was confirmed in the reference [13]. In this context, Cao Yangliu proposed the necessity of designing an outlet toy for autistic children's aggressive behavior [8].

Now, toy-play interventions for children with autism are affecting them on a large scale. More and more researchers and practitioners of adjuvant therapy use toys and games as therapeutic interventions. At this point, practitioners and related researchers and designers differ in the types and functions of toys they choose. The second issue that needs to be addressed is raised in this context: the current toy industry lacks product inclusion and product mix features, which children with autism cannot use at different stages of development [13].

There are also many researchers working on the design of robots for children with autism. Robot toys for children with autism undoubtedly have considerable advantages. It can help children with autism develop interaction and emotional interaction more quickly. However, due to the high cost, the scope of such robot players is limited.

2.2 Development Status of Autistic Children and Related Toys

Autism Spectrum Disorder (ASD) is attracting increasing attention worldwide [14]. Parents often fail to recognize the different nature of an autistic child and try to treat them in the same way as other children. Not to be ignored: Children with autism and autism spectrum disorders have a high incidence of irritability and aggression. In one study, up to twenty per cent of children with autism had symptoms of irritability and aggression, including aggression, severe tantrums, and deliberate self-harm [15]. In addition, several studies have shown similar results. Boys with autism, for example, score significantly higher on irritability than healthy, average boys, and they report a pattern of irritability symptoms very similar to boys with severe mood disorders [16]. Such behavior can cause these children to become increasingly isolated from social interactions, leading to more isolation and terrible human behavior.

However, research shows that children with autism enjoy playing with toys just as much as other children [14]. This observation has led to an increase in the use of toys for this particular group of users. In other words, "playful activities can be a source of learning and skill building, acting as their teacher in a way" [14]. Games are the most natural way for children to express themselves. They allow children to express their subconscious fantasies and explore and understand the external world [12]. It should not be ignored that people with autism spectrum disorder (ASD) often experience difficulties with emotion regulation (ER) [17]. Moreover, in the present study, the necessity of toy design for aggressive behaviors of autistic children has been proposed and confirmed by Cao Yangliu in her research in 2021 [8].

In 2021, Laurie's research proved increased and higher levels of joint attention when children had to share a toy between them on both digital and non-digital interfaces [18]. It proposed that "tangible and smart technologies can create social opportunities for autistic children" [18]. A similar point was made in 2022. The study indicated that while educational robot toys benefit typical children, the currently available mind-controlled ones do not possess educational features [19]. The above findings represent part of the current research trend combining intelligent technology and robot technology, an important research direction for treating and intervening in autistic children [20]. So far, it is still not a mature solution. As a result, Yousif still proposed in the 2020 journal that the future research direction is to apply low-priced educational robots to low-income countries [21]. There are currently no toys on the market that can effectively deal with the irritability of autistic children.

In addition to the variety of intelligent robots, another problem is more appropriate for regular toys: autistic children often lack play-toy options that non-autistic children don't usually meet [22]. To deal with this phenomenon, researchers must design a toy for autistic children with less technology than robots. They can effectively guide or relieve the irritability of children with autism.

Previous research has established the connection between how children interact with objects and the potential early identification of children with autism. TUI toys have also increased social interaction among children [23]. This proof of these theories provided the idea for this research on ASD children's toys containing TUI elements. TUI toys have sound manipulation and diversity, satisfy the desire of children with autism to explore, and can provide auxiliary treatment and psychological adjustment to children with ASD through interactive social games [9].

It is worth mentioning that Soysa & Al Mahmud also found conductive tape patterns with conductive foam can be used to create cost-effective passive tangible toys for TUI in 2019 [23]. The low-cost raw materials of TUI toys are constantly developing, but the design is not free from the limitations of electronic technology and intelligent technology. These toys still require a certain degree of technology to provide corresponding functions, achieve flexible and changeable forms and ways of playing, and more for wealthier countries [23]. Therefore, designing products with low technology, low cost, and emotional guidance functions is necessary.

3 Methodology

The data collection method of this study applies in-depth interviews as its primary mode of enquiry. In addition, this study also designed the self-views of individual respondents. The interview content was developed to obtain the data variables and conduct relevant qualitative research on the data content. Then, the interview content is further optimized, and the prediction method is adopted to make it easier for the interviewee to understand and accept the interview questions.

At the same time, the study used open-ended questions with no direct conclusions about the answers. A sample is studied with a small number of specific people. Malaysia and China will be the target populations for the study. Qualitative research uses researchers as tools to constantly collect and accumulate facts in the natural environment to discover theoretical results. This process of induction, that is, the accumulation of points before reasoning. The research aims to understand facts through descriptive analysis of social phenomena. In addition, the sampling method of this study is judgment sampling, in which researchers determine the study samples according to specific purposes and subjective judgments. Researchers make subjective judgments based on their research purposes and the availability of samples [24]. The sample size for this study was five people, of whom three were from China, and two were from Malaysia.

Judgment sampling, also known as "deliberate sampling", refers to the method of sampling units that are considered to be most representative of the overall sample based on the subjective experience of the investigator.

First-line autistic children treatment teachers are very familiar with the field of autistic children and generally have a good understanding of the investigation. Therefore, I used frontline treatment teachers for autistic children or experts in related research fields as samples to obtain representative sample data.

The following Table 1 provides background information about the 5-digit sample. The interview is divided into the following three parts. The detailed content of the interview is divided into the following three parts (see Table 2, Table 3, Table 4 and Table 5).

Table 1. Interview sample data sheet

Serial number	Gender	Local area	Education background	Years of service
1	Male	Malaysia	Associate professor	3-5 years
2	Female	Malaysia	PhD	5 years
3	Female	China	Bachelor's degree	2-3 years
4	Female	China	Bachelor's degree	8 years
5	Female	China	Bachelor's degree	8 years

Table 2. Background and experience-related questions

No	Question	Number	Project part	Page
1	Can you introduce yourself? Experience in the field of teaching children with autism	1	A、 B	1-2
2	How do you feel about children with autism that you work for who are doing so well?	1	B	2
3	Whether the responsibility will bring corresponding pressure?	1	B	2

Table 3. Emotionalization and other related questions

No	Question	Number	Project part	Page
1	Tell us in more detail about your responsibilities and tasks as a teacher of autistic children	1	A、 B	1-2
2	How do you understand the key factors in treating children with autism?	1	B	2
3	Tell me a little bit about how you intervene in emotional therapy as a teacher at a rehabilitation facility for autistic children	1	B、 C	2-3
4	Talk about your responsibilities in your position of responsibility	1	B	2

Table 4. Emotionalization and other related questions

No	Question	Number	Project part	Page
1	From your point of view, what kind of emotional release toys do you want to produce for autistic children in the future?	1	C	3
2	Understand the expectations and ideas of teachers within the organization regarding vent toys	1	C	3
3	How to understand the biggest factors affecting the emotions of autistic children?	1	A	2

Table 5. Other questions

No	Question	Number	Project part	Page
1	What is your most successful example in this field?	1	B	2
2	The rationality of the process of teacher intervention	1	B	2

4 Findings

The critical data collected in the interview were coded tree framework, and the answers obtained were classified and matched (see Figure 1 and Table 6; similar responses are identified).

The researchers analyzed the data from the perspectives of teachers of children with autism and specialists in treatment facilities for children with autism. From the standpoint of China and Malaysia, the data suggests that toys for autistic children should be more focused on allowing autistic children to express their emotions and thoughts. Like the trend in emotional research on children with autism, this concept has much potential for development. Also, cannot be ignored is the sustainable and low-cost design of toys for autistic children, which contributes to the realization of sustainable development strategies, promoting the equity of special education and achieving the controllable cost. For example, TUI elements are added to low-tech toys for autistic children to perform functions similar to the "visual cards".

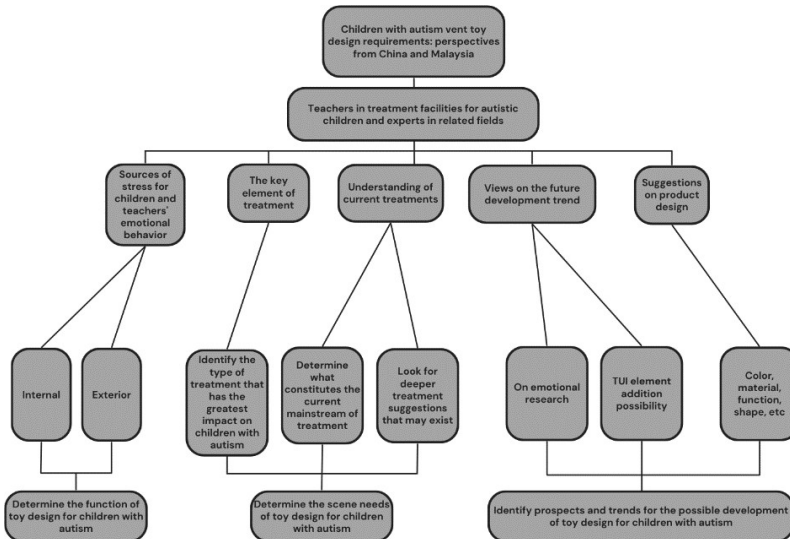


Fig. 1. Interview analysis coding tree

Table 6. The interview data correspond to the classification table

	Research Question 1: What forms of stress reduction design can be reflected in toys?	Research Question 2: How are TUI elements represented in children's toys?	Research Question 3: What kind of design can balance the sustainability and low cost of toys for autistic children?
Research Objectives 1: To explore the existence mode of venting design of toys for autistic children To analysis Multiblock methods and regression analysis of the environmental dataset.	<ul style="list-style-type: none"> • Motion toy • Like bright colors very much • Emotional toys are fun • Animal • Role playing type • Give emotions a chance to vent 	<ul style="list-style-type: none"> • Emotionalization • Color, environment • Family atmosphere • Intervention therapy 	<ul style="list-style-type: none"> • Equal • Addressing aggressive behavior in children • Home environment use • Under improvement • Game-based
Research Objective 2: Apply the design concept of TUI (tangible user interface) to toys for autistic children.	<ul style="list-style-type: none"> • To develop small videos and cartoons, we can also have social story picture books and social story books • Sensory stimulation • More optimistic about this direction of development • There are few toys of this type on the market 	<ul style="list-style-type: none"> • Emotional venting • Guide and protect • There is optimism about this trend 	<ul style="list-style-type: none"> • Remove core barriers • Find meaningful alternative behaviors • It has a positive impact on the stage of compulsory education • Nonverbal communication • Keep the kids calm
Research Objective 3: To utilize the combination of contemporary toy forms and TUI elements to design an environmentally friendly toy for children with autism that conforms to the SDG concept.	<ul style="list-style-type: none"> • Use pictures as a form of communication • Use visual strategies, such as picture cards • You can feel pressure on your skin or body 	<ul style="list-style-type: none"> • Release emotion • Use any strategy to express yourself • Toy safety 	<ul style="list-style-type: none"> • Consider materials, safety • Clean energy • Cost, process

5 Discussion

Based on the above analysis results, the design concept of combining various analysis summaries is to design a low-tech, emotionally related toy for autistic children. The advantage of this study is that it is in the face of the current global research trend on children with autism and the economic downturn caused by COVID-19. The timing is right to accelerate research on toys for children with emotional autism, and it is an excellent time to launch such designed products. Although there are some aspects of scientific and technological innovation, the cost is controlled within the affordable range of low - and middle-income families, and the most important thing is that consumers can change independently according to their functions after purchase to extend the use cycle of the product. Meanwhile, healthy anti-fall materials so that consumers do not have to worry about the safety of autistic children and product damage.

The purpose of these functions is to give this particular group of autistic children a real family emotional release toy that can be played with so that they can be well-guided and released when they have an emotional breakdown. The drawback is that the sample size of this study is small, and the collected data cannot represent the broader research trend.

6 Conclusion & Recommendations

This study collected the interview content of 5 interviewees and analyzed the design needs of emotional decomposition toys for autistic children from two international perspectives: China and Malaysia. The category of toys that need to be added to the study of the toy needs of children with autism are low-tech family breakdown toys. As a study, the data also suggests that incorporating TUI elements of a tangible user interface into a small family product could be considered in the future, bringing more possibilities to the field of toys for children with autism. For the autistic community, as the number of children involved continues to rise, the solution to today's fast-paced life should not be the same as ordinary children's toys.

Finally, we acknowledge that this study has some limitations. First, as a design research analysis, this study only uses limited databases to retrieve information that may exclude some influential articles. In addition, the individual manual screening process has a particular subjectivity. Therefore, future studies should use a wider database to search publications to improve the accuracy of the analysis. Despite the limitations, the findings present a compelling trend for future research, suggesting that toy design for children with autism should focus on low-tech, low-cost emotionalized products in the Chinese and Malaysian contexts.

Acknowledgement. We are grateful for the technical assistance from the Postgraduate Center, College of Creative Arts, in managing the research ethics process. Heartfelt thanks to Dr. Ahmad Zamir Che Daud and Dr. Ida Hasni Shaari, lecturers at UiTM Selangor, for allowing us access to the facility and data collection via video conferencing. Finally, to all the respondents who will

remain anonymous for privacy and confidentiality, their contribution to user feedback is immeasurable towards the design development.

Paper Contribution to Related Field of Study. The study conducted by the researchers can serve as a valuable reference for future studies in emotional human factors related to autistic children and toy design. It may also provide potential insights for researchers in designing toys for autistic children.

References

1. Divan, G., Bhavnani, S., Leadbitter, K., Ellis, C., Dasgupta, J., Abubakar, A., Elsabbagh, M., Hamdani, S. U., Servili, C., Patel, V.: Annual Research Review: Achieving universal health coverage for young children with autism spectrum disorder in low-and middle-income countries: A review of reviews. *Journal of Child Psychology and Psychiatry* **62**(5), 514–535 (2021)
2. Bakker, T., Krabbendam, L., Bhulai, S., Begeer, S.: Background and enrolment characteristics of students with autism in higher education. *Research in Autism Spectrum Disorders* **67**, 101424 (2019)
3. Chen, H., Yang, T., Chen, J., Chen, L., Dai, Y., Zhang, J., Li, L., Jia, F., Wu, L., Hao, Y.: Sleep problems in children with autism spectrum disorder: a multicenter survey. *BMC psychiatry* **21**, 1–13 (2021)
4. Miller, H. L., Caçola, P. M., Sherrod, G. M., Patterson, R. M., Bugnariu, N. L.: Children with Autism Spectrum Disorder, Developmental Coordination Disorder, and typical development differ in characteristics of dynamic postural control: A preliminary study. *Gait & posture* **67**, 9–11 (2019)
5. Russell, G., Stapley, S., Newlove-Delgado, T., Salmon, A., White, R., Warren, F., Pearson, A., Ford, T.: Time trends in autism diagnosis over 20 years: a UK population-based cohort study. *Journal of Child Psychology and Psychiatry* **63**(6), 674–682 (2022)
6. Howard, K. B., Katsos, N., Gibson, J. L.: The school experiences of bilingual children on the autism spectrum: An interpretative phenomenological analysis. *Research in Developmental Disabilities* **87**, 9–20 (2019)
7. Nayar, K., Sealock, J. M., Maltman, N., Bush, L., Cook, E. H., Davis, L. K., Losh, M.: Elevated polygenic burden for autism spectrum disorder is associated with the broad autism phenotype in mothers of individuals with autism spectrum disorder. *Biological Psychiatry* **89**(5), 476–485 (2021)
8. Cao, Y.: Emotions for Aggressive Behavior in Children with Autism Intervene in Product Design, <https://kns.cnki.net/kns8/defaultresult/index>
9. Francis, G. A., Farr, W., Mareva, S., Gibson, J. L.: Do Tangible User Interfaces promote social behaviour during free play? A comparison of autistic and typically- developing children playing with passive and digital construction toys. *Research in Autism Spectrum Disorders* **58**, 68–82 (2019)
10. Soysa, A. L., Al Mahmud, A.: Tangible Play and Children with ASD in Low-Resource Countries: A Case Study. In: *Proceedings of the Fourteenth International Conference on Tangible, Embedded, and Embodied Interaction*, pp. 219–225, Sydney (2020)
11. Deshpande, A., Ranavaade, V.: Importance of Toy Play in Special Education for young Children: Perspectives and Approaches. *Revista Geintec-Gestao Inovacao E Tecnologias* **11**(4), 5218–5229 (2021)

12. Yang, J., Cang, S.: Research on Design of Toys to Enhance Autistic Children's Social Skills. *Advances in Social Sciences* **9**(4), 508–515 (2020)
13. Cañete Yaque, R., López, S., Peralta-Álvarez, M. E.: KEYme: Multifunctional Smart Toy for Children with Autism Spectrum Disorder. *Sustainability* **13**(7), 4010 (2021)
14. Qidwai, U., Kashem, S. B. A., Conor, O.: Humanoid robot as a teacher's assistant: helping children with autism to learn social and academic skills. *Journal of Intelligent & Robotic Systems* **98**(3), 759–770 (2020)
15. Robb, A. S.: Managing irritability and aggression in autism spectrum disorders in children and adolescents. *Developmental disabilities research reviews* **16**(3), 258–264 (2010)
16. Mikita, N., Hollocks, M. J., Papadopoulous, A. S., Aslani, A., Harrison, S., Leibenluft, E., Simonoff, E., Stringaris, A.: Irritability in boys with autism spectrum disorders: an investigation of physiological reactivity. *Journal of Child Psychology and Psychiatry* **56**(10), 1118–1126 (2015)
17. Reyes, N. M., Pickard, K., Reaven, J.: Emotion regulation: A treatment target for autism spectrum disorder. *Bulletin of the Menninger Clinic* **83**(3), 205–234 (2019)
18. Laurie, M. H., Manches, A., Fletcher-Watson, S.: The role of robotic toys in shaping play and joint engagement in autistic children: implications for future design. *International Journal of Child-Computer Interaction* **32**, 100384 (2022).
19. Khalid, S. J., Ali, I. A.: Mind Controlled Educational Robotic Toys for Physically Disabled Children: A Survey. In: 2022 International Conference on Computer Science and Software Engineering (CSASE), pp. 348–354, IEEE (2022)
20. Billard, A., Robins, B., Nadel, J., Dautenhahn, K.: Building Robota, a mini-humanoid robot for the rehabilitation of children with autism. *Assistive Technology* **19**(1), 37–49 (2007)
21. Yousif, J.: Humanoid robot as assistant tutor for autistic children. *International Journal of Computation and Applied Sciences* **8**(2), 8–13 (2020)
22. Aqel, M. O., AlHalabi, A., Jabre, A.: Development of Color Following Robot for Interaction with Autistic Children. In: 2020 International Conference on Assistive and Rehabilitation Technologies (iCareTech), pp. 137–142, IEEE (2020)
23. Soysa, A. I., Al Mahmud, A.: Interactive Pretend Play (iPPy) toys for children with ASD. In: Proceedings of the 31st Australian Conference on Human-Computer- Interaction, pp. 285–289, Association for Computing Machinery, Freemantle (2019)
24. Perla, R. J., Provost, L. P.: Judgment sampling: a health care improvement perspective. *Quality Management in Healthcare* **21**(3), 169-175 (2012)

Open Access This chapter is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits any noncommercial use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license and indicate if changes were made.

The images or other third party material in this chapter are included in the chapter's Creative Commons license, unless indicated otherwise in a credit line to the material. If material is not included in the chapter's Creative Commons license and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder.

