

LEGO[®] Therapy and the Social Use of Language Programme: An Evaluation of Two Social Skills Interventions for Children with High Functioning Autism and Asperger Syndrome

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Abstract LEGO[®] therapy and the Social Use of Language Programme (SULP) were evaluated as social skills interventions for 6–11 year olds with high functioning autism and Asperger Syndrome. Children were matched on CA, IQ, and autistic symptoms before being randomly assigned to LEGO or SULP. Therapy occurred for 1 h/week over 18 weeks. A no-intervention control group was also assessed. Results showed that the LEGO therapy group improved more than the other groups on autism-specific social interaction scores (Gilliam Autism Rating Scale). Maladaptive behaviour decreased significantly more in the LEGO and SULP groups compared to the control group. There was a non-significant trend for SULP and LEGO groups to improve more than the no-intervention group in communication and socialisation skills.

Keywords LEGO[®] therapy · Social skills · High functioning autism · Asperger syndrome

Introduction

Social communication skills play a vital role in our ability to form meaningful social relationships and enable us to function happily and successfully in everyday life. Successful social interaction requires a multitude of skills that typically developing individuals learn without the need for direct teaching. Individuals with autism do not naturally acquire these sophisticated social skills, and this has a great impact on all aspects of their lives. Social impairment

forms a fundamental part of the diagnostic classification of autism (APA 1994) and is a “core feature” of autism (Baron-Cohen 1995; Hobson 1993; Sigman 1994). Social competence is also a predictor of long-term outcome for individuals with autism (National Research Council 2001) so helping children with autism to develop appropriate social skills is of huge importance for their future.

Children with autism are less likely to initiate interactions with peers, spend less time interacting with peers, have lower “quality” interactions and spend a larger amount of time in non-social play (Lord and Magill-Evans 1995; McGee et al. 1997; Sigman and Ruskin 1999). These characteristics limit the opportunity to engage in social interactions, practice social strategies and gain social confidence, skills which are vital for social independence. A large body of research has therefore been conducted to evaluate interventions that help children with autism improve these social abilities.

Many social skills interventions exist, yet few have a strong empirical basis to support their effectiveness (McConnell 2002; Owens et al. 2008; Rogers 2000). There is also a well-documented problem with generalisation of skills (Plaisted 2001; Rimland 1965).

For school-age children with high functioning autism (HFA) and Asperger Syndrome (AS), a widely used method for teaching social skills is Social Stories (Gray 1998; Gray and Garand 1993). In this method, an adult creates written stories to teach social rules in a supportive and non-judgemental way. Despite this method being accessible and easy to implement, studies evaluating its effectiveness report variable results (Delano and Snell 2006; Lorimer et al. 2002; Reynhout and Carter 2006; Swaggart et al. 1995). Peer-mediated behavioural interventions have some good evidence for their effectiveness at improving social competence. In these approaches, a

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typically developing peer is taught to elicit, prompt and reinforce social behaviour for a child with autism (Lord and Magill-Evans 1995; Rogers 2000; Shafer et al. 1984; Strain et al. 1979). Despite their effectiveness, peer-mediated approaches are complex and time-consuming to carry out and are usually used with preschoolers. This minimises their applicability to the wider community and to school-age children.

Social skills groups may be particularly suitable for school-age children with HFA and AS who are at mainstream school or in an inclusion unit within a mainstream school and who need extra help with social skills in particular. There are good opportunities in the school setting to include typically developing peers as social role models, if not as peer “therapists”. Research into school-based social skills groups has focused on increasing a broad range of skills in short and frequent classroom sessions (Kamps et al. 1992; Matson et al. 1991), or have focused on teaching specific skills such as theory of mind, eye-contact or play with preferred toys (Baker et al. 1998; Koegel and Frea 1993; Ozonoff and Miller 1995). In clinic settings, groups are usually less frequent but sessions are longer (e.g. 1 h) and usually without the presence of typically developing peers. Research suggests that clinic-based groups can be effective at teaching appropriate social initiations and responses, emotion recognition and group problem solving, though generalisation is still a problem (Barry et al. 2003; Solomon et al. 2004).

Using “naturalistic” approaches may improve generalisation (Delprato 2001; Kohler et al. 1997). Here, naturally reinforcing materials and activities are used in settings as close to every day life as possible. Using children’s natural interests to promote learning will increase motivation to participate in interventions (Attwood 1998; Koegel 1995) and learning in real-life situations improves the generalisation of skills to every day settings (Delprato 2001). One social skills group that has used a naturalistic approach and has succeeded in demonstrating generalisation is LEGO® therapy. LEGO therapy is a social skills intervention for school-age children based around collaborative LEGO play (LeGoff 2004; LeGoff and Sherman 2006). It has the potential to be widely used in both school and clinic settings.

LEGO therapy is based on the idea of using the child’s natural interests to motivate learning and behaviour change. A typical LEGO therapy project would aim to build a LEGO set, importantly with a social division of labour. In a group of three people (which could be comprised of children with autism, peers and/or adults), one person is designated the “engineer”, one the “supplier” and the other the “builder”. Individuals have to communicate and follow social rules to complete the LEGO build. Each activity requires verbal and non-verbal communication, collaboration, joint problem-solving, joint creativity and joint attention to the task.

Participating in the group is inherently rewarding and no external rewards are required (LeGoff 2004).

LEGO is a highly structured, predictable and systematic toy. It is therefore likely that children with HFA and AS will be motivated by tasks involving this toy, due to the fact that individuals with autism are particularly attracted to systems (Baron-Cohen 2002, 2006; Baron-Cohen et al. 2003). The appeal of systems has been used to motivate children to improve their emotion recognition skills (Golan and Baron-Cohen 2006). Adapting LEGO building to help children improve social interactions therefore seems justified. In fact, Dewey et al. (1988) found that after rule-governed games, construction materials (LEGO is an example of a construction material) were the next most effective means of facilitating complex social interactions in pairs of children with autism in contrast to dramatic play and functional play.

Previous research evaluating LEGO therapy reported that following 24 weeks of therapy (90 min group session; 1 h individual session per week), significant improvement in social competence was found in 47 children with autism (LeGoff 2004). No improvement in social competence was made while these children were on the waiting list for therapy, demonstrating that improvements were not a result of maturation, and that LEGO therapy was better than having no intervention at all. Frequency of initiating social contact and the duration of social interactions in the school playground significantly increased following therapy, suggesting that generalisation occurred, at least to the school playground setting. A subsequent study evaluated the long-term outcome of LEGO therapy in comparison to unspecified 1:1 paraprofessional support for a similar number of hours. Results showed that at 3-year follow up, participants receiving LEGO therapy improved significantly more than the comparison group (LeGoff and Sherman 2006). However, participants in this study were not randomly allocated to the different treatment conditions. Nevertheless, these findings suggest that LEGO therapy is a promising intervention to improve social and communicative abilities in children with HFA and AS that has good potential to be used in school, clinics and at home. An independent evaluation of this approach, comparing LEGO therapy to an alternative yet specific social skills programme, is warranted.

The present study independently evaluates the effectiveness of LEGO therapy (LeGoff 2004) in comparison to another social skills programme called the Social Use of Language Programme (SULP; Rinaldi 2004). SULP is a social-communication teaching approach for children with learning difficulties that is widely available and often used in schools to help children with autism. It has not yet been empirically evaluated for children with autism, despite anecdotal reports of effectiveness (Macaskill 2004).

The Social Use of Language Programme, like LEGO therapy, can be used in both school and clinic settings and is a low-intensity, easy to implement intervention. Rather than using a naturalistic collaborative play approach like LEGO therapy, Sulp uses a clear curriculum and a hierarchical learning approach to teach social and communication skills. Teaching starts with stories about monsters that experience social difficulties and progresses to adult modelling, child practise and games within the group setting and carry-over to new situations to encourage generalisation. Though Sulp activities are enjoyable, the rewards are not always inherent in the activities and it is recommended to use stickers and small treats to reward participation. Training courses and books for the Sulp programme are available in the UK and it is a programme that is frequently used by speech and language therapists and teachers and warrants evaluation.

The study reported here evaluates the effectiveness of LEGO therapy and the Sulp as low-intensity, easy to implement social skills groups for 6–11 year olds with HFA and AS that contrast in their method of teaching (LEGO therapy uses a naturalistic collaborative play approach while Sulp uses more direct teaching methods). They will be compared to a control group of children with autism who do not receive any intervention. Typical peers were not included in the groups as the interventions were voluntary, required a long-term commitment and were run from a clinic where, in comparison to a school setting, typically developing children were less able to attend.

Methods

Participants

Participants were recruited through the Autism Research Centre database, the Cambridge Asperger Outreach Clinic, Umbrella Autism (a local autism charity) and local primary schools. Initially, participants were recruited for the LEGO and Sulp groups only. The study was described to parents as an evaluation of two types of social skills programme (LEGO therapy and the Sulp). LEGO and Sulp groups were run without a no-intervention control group due to concerns about high attrition rates in a no-intervention group. The no-intervention control group was recruited from the Autism Research Centre database at a later date. Control group participants were part of a different study examining parents' opinions of different interventions and the development of social skills over 6 months. Parents in this study were asked if the information collected in the social development study could be used as a comparison for the LEGO/Sulp study and were told they would be part of a control

group for a study evaluating the effectiveness of social skills interventions for children with autism. The research was approved by Cambridge University Psychology Research Ethics Committee and all parents gave written informed consent. Parents also filled in an initial background questionnaire, to gather information about demographics, education, additional interventions, medication and development. This questionnaire specifically asked if children were receiving any social skills interventions or other treatments for autism, were taking any medications or were following a special diet.

Criteria for inclusion in the study consisted of a current diagnosis of HFA, autism spectrum disorder, autism or AS by a clinical psychologist, psychiatrist or paediatrician. Diagnoses were confirmed during the course of the study using the Autism Diagnostic Interview-Revised (Lord et al. 1994) for the children in the intervention groups or the Social Communication Questionnaire (Rutter et al. 2003) for the children in the control group (the full ADI was not used for children in the control group due to lack of human resources, but diagnoses were made by qualified clinical psychologists, psychiatrists or paediatricians).

Children were included in the study if they were between 6 and 11 years old, had an IQ > 70, reached cut-off on the ADI or SCQ and were able to speak in phrases (it was assumed that some language ability was a prerequisite for explaining both the rules of LEGO therapy and to use the materials in Sulp). Inclusion criteria specified that children were currently receiving no other behavioural interventions or social skills groups, were attending mainstream education or an inclusion unit within a mainstream school, and had no additional diagnoses of childhood psychiatric disorders. Some children in the study were receiving speech and language therapy, occupational therapy or were following a special diet. Most children were receiving some form of educational support, usually 1:1 support from teaching assistants. The number of children in each group receiving additional intervention and educational support is given in Table 1.

Recruitment for the LEGO therapy and Sulp groups occurred in two phases due to the length of time it took to run therapy groups. Figures 1 and 2 give a consort diagram of the group make-up for the different recruitment phases. Complete data for 31 children (30 boys, 1 girl) were available for analysis at the end of the study.

Procedure

For all groups, an initial assessment session was carried out. In this session IQ was measured using the Wechsler Abbreviated Scales of Intelligence (Wechsler 1999) and parents completed the following questionnaires to assess autism symptom severity and co-morbid symptoms: the

Table 1 Characteristics of participants

	LEGO® <i>n</i> = 16	SULP <i>n</i> = 15	No intervention <i>n</i> = 16
CA (months)			
Mean	99.13	97.33	105.81
SD	20.14	22.33	16.05
Median test	$\chi^2 = 1.83$, <i>df</i> = 2, <i>p</i> = 0.40		
Gender			
Male	16	14	16
Female	0	1	0
Full IQ			
Mean	113.93	106.87	108
SD	16.97	17.15	14.48
Median test	$\chi^2 = 1.20$, <i>df</i> = 2, <i>p</i> = 0.37		
Verbal IQ			
Mean	110.4	100.62	105
SD	16.24	22.62	15.61
Median test	$\chi^2 = 1.22$, <i>df</i> = 2, <i>p</i> = 0.54		
GARS AQ			
Mean	81.75	86.27	93.19
SD	16.39	13.53	18.23
Median test	$\chi^2 = 1.13$, <i>df</i> = 2, <i>p</i> = 0.57		
Diagnosis			
HFA	5	1	2
AS	8	8	11
ASC	2	4	2
A	1	2	1
Educational support			
Part time 1:1 TA	4	4	8
Fulltime 1:1 TA	7	4	2
Inclusion unit	1	3	2
Additional Intervention			
SALT (up to once a week)	3	4	7
OT (1 × per week)	0	0	4
Medication	0	0	0
GF/CF diet	1	0	1

CA chronological age, GARS-AQ Gilliam autism rating scale autism quotient, HFA high functioning autism, AS Asperger syndrome, ASC autism spectrum condition, A autism, SALT speech and language therapy, OT occupational therapy, GF/CF diet gluten free/casein free diet

Gilliam Autism Rating Scale (Gilliam 1995), the Spence Children's Anxiety Scale (Spence 2000), the Conner's ADHD index, (Conners 2001) and the Child Behaviour Checklist (Achenbach and Rescorla 2001).

In the intervention groups, participants were matched into pairs based on availability, chronological age, IQ, autism symptom severity (GARS), and verbal IQ. Groups were run on different days, so availability had to be taken

into consideration when matching (i.e. children who were only available on the same day were put into different pairs). One child in each pair was then randomly assigned to the LEGO therapy group, and one to the SULP group.

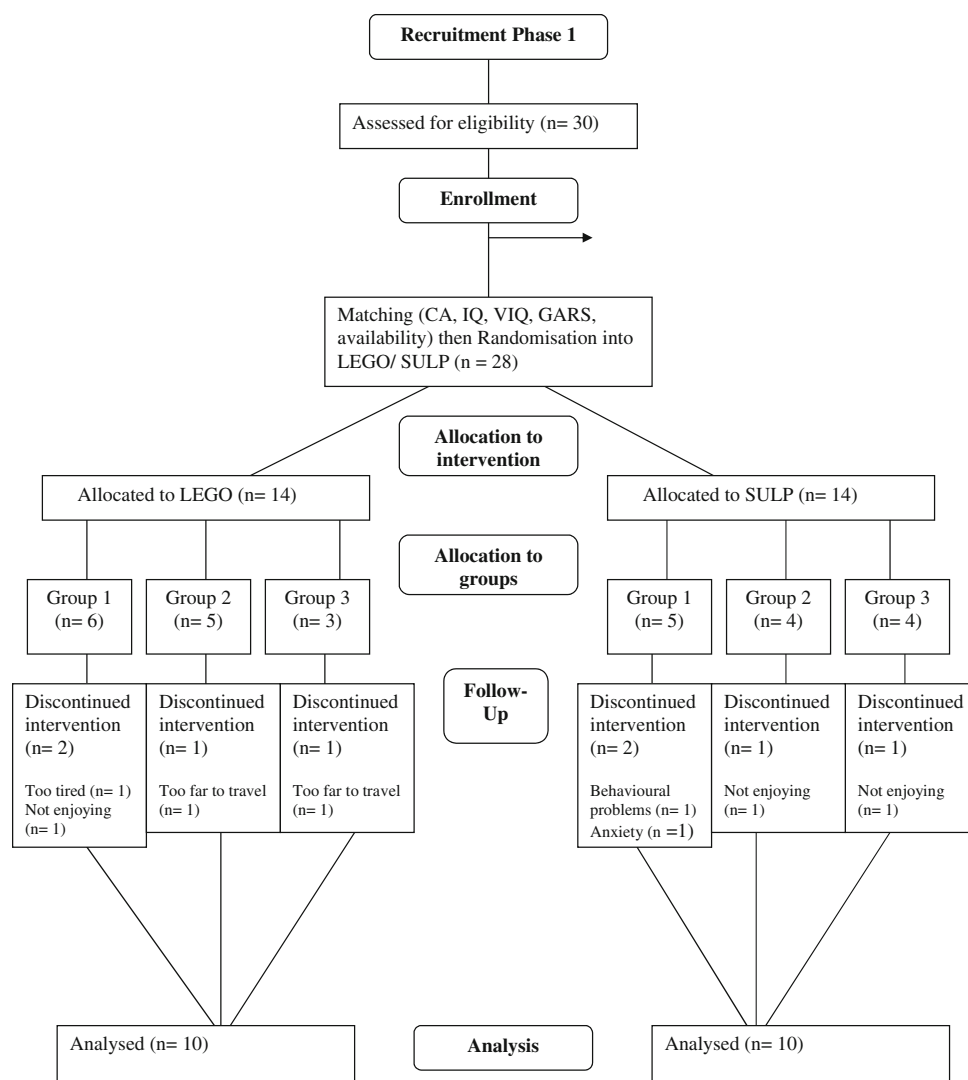
The no-intervention control group was matched to the therapy groups on chronological age, full IQ, verbal IQ and autism symptom severity (GARS). The characteristics of the children who completed the study are described in Table 1.

Children attended therapy for 1 h per week for 18 weeks. Taking into account the holidays, the total duration of the study was 5.5 months. The control group data were collected over the course of 5.5–6 months.

In contrast to LeGoff's original study (LeGoff 2004), no individual therapy sessions were provided. Groups were run after school by the first author and undergraduate volunteers. The first author attended a week long training course in Philadelphia with Dr LeGoff to learn LEGO therapy and followed a draft manual produced by Dr LeGoff. She also attended a 2-day SULP training course and followed the SULP manual. Undergraduate volunteers attended a day long training run by the first author in SULP or LEGO therapy. The first author ran every therapy group with help from one or two undergraduate volunteers, depending on the group size. Undergraduate volunteers were always supervised by the first author.

LEGO Therapy

Children in the LEGO therapy group participated in collaborative LEGO play. The idea behind LEGO therapy is to motivate children to work together by building in pairs or small groups. A typical project was to build a LEGO set in groups of three, dividing the task into different roles. One child acts as the “engineer” (describes the instructions), one is the “supplier” (finds the correct pieces) and the other is the “builder” (puts the pieces together). Children would play their role for a certain length of time, or a certain number of steps in the instructions and then swap around. This division of labour with a common purpose allows children to practice joint attention, turn taking, sharing, joint problem solving, listening and general social communication skills. The group of three either consisted of three children, plus an adult supervisor. When there were not enough children to form a group of three, children either worked in groups of two, omitting the part of the “engineer” or an adult played the third role. Another way of working together with LEGO happened during “Freestyle” LEGO activities in which children design and build a model in pairs, for example, a space rocket. This allowed children to practice compromise, expressing their ideas clearly and taking other people's perspectives and ideas into account. Children started off building quick and

Fig 1 Consort diagram for recruitment phase 1

simple models in pairs or threes with constant adult supervision. Once children could build proficiently in a small group, they moved on to more complex, longer term models that took a few sessions to build. Eventually, children were able to build together with minimal adult intervention. At this stage children were given “Freestyle” activities to do, as this was a less structured, more challenging way of working together.

During LEGO therapy children were asked to follow some “LEGO Club Rules” to follow (see Table 2) and were asked to remind each other to adhere to the rules.

The therapist’s role was not to point out specific social problems or give solutions to social difficulties rather they highlighted the presence of a problem, and helped children to come up with their own solutions. For example, “Johnny” is talking to “Freddy” but “Freddy” isn’t listening:

Therapist says, “We have a problem here, can you tell me what it is?”

Johnny might say, “Freddy isn’t listening to me”, Therapist says, “Oh dear, how do you feel when Freddy isn’t listening?”

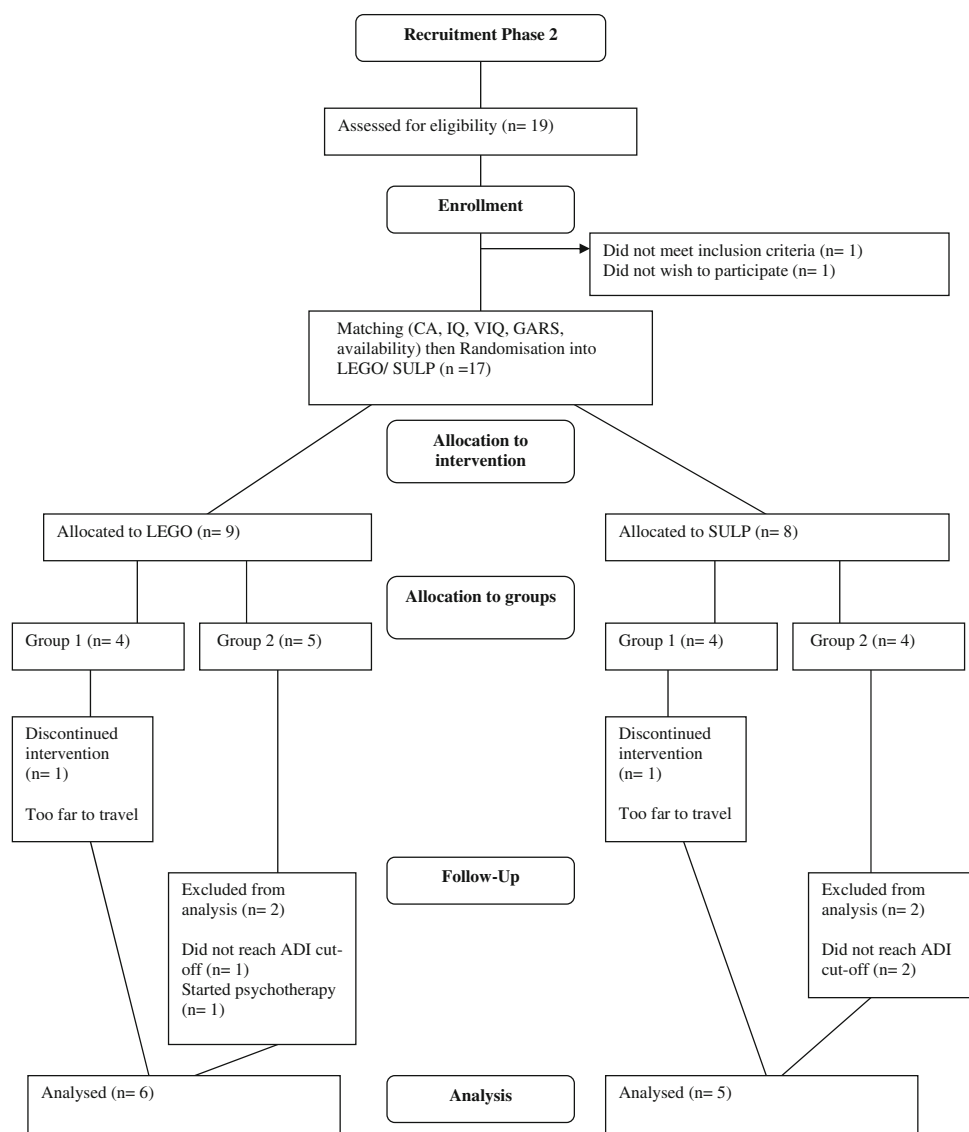
Johnny, “Really cross”

Therapist, “Yeah, it might make you cross when someone isn’t listening to you. Johnny, can you think of a way to help Freddy listen to you?”

Johnny might say, “Say his name first?”

Therapist says, “Wow, that’s a great idea! You could say his name to get his attention. Why don’t we have a practise?”...

Solutions that children have come up with are practised until they can do it, and the therapist can remind children of strategies in the future if similar difficulties arise. In an average session that lasted 1 h, several social issues would arise and the therapist would intervene approximately every 5 min. More intervention was required at the start of the study as children were getting used to the nature of building LEGO in groups.

Fig. 2 Consort diagram for recruitment phase 2**Table 2** LEGO® club rules**LEGO® CLUB RULES!**

1. Build things together!
2. If you break it you have to fix it or ask for help to fix it.
3. If someone else is using it, don't take it, ask first.
4. Use indoor voices- no yelling.
5. Keep hands and feet to yourself.
6. Use polite words.
7. Clean up and put things back where they came from.
8. Do not put Lego bricks in your mouth.

There were different levels of skill that could be attained in LEGO therapy. “LEGO Helpers” were able to find bricks and sort bricks into their correct colours. “LEGO Builders” were able to build models in a group and design freestyle models with adult help. “LEGO Creators” were

able to build models in groups and design freestyle models in pairs without adult help. Once children could demonstrate the skills at a particular level, children were given a certificate to reward their achievement in front of all the children at the end of the therapy session (e.g. when they built in a group successfully for the first time, they were given a “LEGO Builder” certificate). Children were awarded certificates on an individual, rather than a group basis and were highly motivated to participate socially and build models together so that they could move up to the next level. Children were allowed to take the certificates home to display on their walls.

The Social Use of Language Programme

The Sulp (Rinaldi 2004) is a direct teaching approach based around stories, group activities and games. Social

and communication skills that are covered include eye contact, listening, turn taking, proxemics and prosody. Sulp teaches these skills using a specified framework for learning that begins with comprehension through stories about monster characters that experience a particular social difficulty, moves on to adult models of good and bad skills that children have to evaluate and then children practise the skill through games and conversation. Sulp encourages children to understand the relevance of the skills they learn about to help improve generalisation of the skills to other contexts. Carry-over tasks to settings outside the group are also suggested, but to be comparable to LEGO therapy, which does not specify any homework, carry-over tasks were not used in this study. Each therapy session covers a specific skill, for example eye contact. This skill may be practised over several sessions before moving on to the next skill in the learning sequence, depending on how quickly the children demonstrate understanding.

An example of an activity sequence for eye contact is as follows: comprehension of the importance of eye-contact is taught using a story about “Looking Luke”, a monster character who has difficulties with eye-contact. His monster friends help him, and children in the group discuss the problems the monster had. An adult model of poor eye-contact and good eye-contact is then shown by the activity leaders and children are asked a series of questions to help them identify mistakes and correct the use of skills. Children then practise the skill themselves in series of games. For example in a game called “magic chair”, children get to sit in the “magic chair” when they make eye contact with the activity leader. They are then rewarded in the chair with a look in a box at an interesting object, e.g. a bubble tube. The next level of practice enables children to practise eye contact as listeners in a communicative context.

The Social Use of Language Programme involves sitting and listening, so children were rewarded with a sticker chart (leading to sweets) for sitting in their chair, listening appropriately, and keeping their hands and feet to themselves. Without these rewards the sessions became difficult to manage.

Outcome Measures

Outcome measures were taken immediately before the start of intervention (time 1) and after 5.5 months time (18 weeks of intervention; time 2). In the control group outcome measures were taken at the start (time 1) and end (time 2) of a 5.5–6 month period.

Vineland Adaptive Behaviour Scale

This is a semi-structured parent interview that measures adaptive behaviour in several domains. The “Socialisation”

domain, “Communication” domain and the “Maladaptive Behaviour” domain were used as outcome measures in this study. The “Socialisation” domain consists of three sub-domains: interpersonal relationships, play and leisure skills and social coping skills. The “Communication” domain is made up of receptive, expressive and written communication sub-domains. Items in the “Maladaptive Behaviour” domain are shown in Table 3.

Test–retest reliability is good, ranging from $r = 0.81$ to $r = 0.88$ in the different domains (Sparrow et al. 1984) and concurrent validity is good (de Bildt et al. 2005; Perry and Factor 1989). Standard scores with a range of 20–160 (mean = 100, SD = 15) were used for the “Socialisation” and “Communication” domains. Raw scores were used for the “Maladaptive Behaviour” domain as no standard score equivalents are provided, due to the fact that Maladaptive Behaviour does not change with age like the other domains of the scale (Sparrow et al. 1984).

In the intervention group, measures at time 1 in the first recruitment phase of the study were carried out by the first

Table 3 Items on the “Maladaptive Behaviour” scale of the VABS
Items in the Maladaptive Behaviour Domain of the VABS

Is overly dependent
Withdraws
Avoids school or work
Exhibits extreme anxiety
Cries or laughs too easily
Has poor eye contact
Exhibits excessive unhappiness
Is too impulsive
Has poor concentration and attention
Is overly active
Has temper tantrums
Is negativistic or defiant
Teases or bullies
Shows lack of consideration
Lies, cheats or steals
Is too physically aggressive
Swears in inappropriate situations
Is stubborn or sullen
Sucks thumb or fingers
Wets bed
Exhibits an eating disturbance
Exhibits a sleeping disturbance
Bites fingernails
Exhibits tics
Grinds teeth
Runs away
Plays truant

author before the children were randomly assigned to groups. Subsequently, the first author started running the therapy sessions so was aware of the type of therapy the children were receiving. To prevent bias, a research assistant blind to group allocation carried out the interviews at time 2. The same research assistant carried out interviews at both time points in the second recruitment phase of the study. She continued to be blind to group allocation. A third research assistant, also blind to group allocation, carried out interviews for the control group participants. Inter-rater reliability was calculated by double-coding 20% of the interviews. Intra-class correlations were excellent (0.97).

Gilliam Autism Rating Scale Social Interaction Subscale

The Social Interaction subscale of this measure was chosen as an indication of social skills specific to autism. This measure was also used in the original evaluations of LEGO therapy (LeGoff 2004). It is a standardised rating that has 14 items scored by parents on a Likert scale (0 = never observed, 1 = seldom observed, 2 = sometimes observed, 3 = frequently observed). Items include, avoiding eye contact, has flat affect, resists physical contact, does not show imitative play, withdraws from group situations, shows anxiety, is unaffectionate, laughs or cries inappropriately, uses toys and objects inappropriately, behaves repetitively, is upset by routine change, has temper tantrums when given directions, and lines things up in order. Higher scores indicate a higher level of impairment. Test-retest reliability is adequate (Gilliam 1995) and internal consistency good $\alpha = 0.85$ (Lecavalier 2005). The raw score is converted into a standard score between 1 and 20 (mean = 10; SD = 1). A score of 10 represents an average disturbance of social interaction for a child with autism.

Parent Satisfaction and Child Enjoyment

Parents of children in the two therapy groups were asked to rate their satisfaction on a scale of 1 (unsatisfied) to 10 (very satisfied) in an evaluation questionnaire given at the end of the study. Parents filled in this questionnaire after the final therapy session and posted it back.

In the final therapy session, children were asked to score the groups out of 10 for enjoyment (1 = didn't enjoy it; 10 = really enjoyed it) by circling a number on a piece of paper. The therapists left the children to fill in the questionnaire by themselves after having explained how to do it.

Direct Measures

To provide a measure of skill generalisation, direct observations were taken before and after intervention.

Twenty-one children who lived locally and who gave consent were observed in the school playground at break time. There were 10 min of suitable data available for each child at both time 1 and time 2 (i.e. no organised activities happening in the playground, not indoor play due to rain, no presence of teaching assistants). No direct measures were available for the children in the control group.

Two aspects of social behaviour were measured following the methods used by LeGoff (2004). The frequency of self-initiated social contact with peers and the duration of social interactions with peers were measured to gain an overall indication of social functioning that was practical to observe in the playground. The peers were familiar typically developing children that attended the same school as the target child, but who did not attend the social skills interventions of this study. A social contact was coded as self-initiated if it did not form part of any routine, was not prompted and was a clear communicative verbal or non-verbal action that was not a response to another's initiation and not with an adult. Duration of all interactions with peers was measured if they were clearly social or play interactions, there was no adult supervision, and the play was clearly interactive and not parallel. See Fig. 3 for a coding scheme.

These observations were carried out by the first author due to the restrictions of access to school playgrounds. Unfortunately, she was also running the therapy groups and so was not blind to group membership. Data from observational measures were collected on a handheld computer using ObsWin (Martin et al. 2000), a computer software package designed for direct behaviour observation. Using this software, you can start and stop coding behaviours of interest at the press of a button.

Results

Due to the small sample size, non-parametric tests were used for statistical analyses. The results for all outcome measures are shown in Table 4 and described below.

Indirect Measures: GARS-SI and VABS

Figure 4 shows the change in GARS-SI scores at time 1 and time 2 for all groups. The Kruskal–Wallis test showed no significant differences between the groups at time 1 ($\chi^2 = 0.844$, $df = 2$, $p = 0.66$). After intervention, at time 2, the Kruskal–Wallis test showed that there was a significant difference between the groups ($\chi^2 = 5.85$, $df = 2$, $p = 0.05$). The LEGO group were scoring significantly lower than the other two groups at time 2, showing an improvement in this measure. Within-group analyses using the Wilcoxon Signed Ranks test showed that there were no

Fig. 3 Playground observation coding scheme

<u>Playground Observation Coding Scheme</u>
Use ObsWin computer software to record the frequency of self-initiated interactions and the duration of all peer interactions, self- or other- initiated.
<u>Self-Initiated Interactions</u>
These include the target child carrying out one of the following behaviours that lead to some form of social exchange. Do not count adult interactions.
<u>Verbal Recruitment</u>
<ul style="list-style-type: none"> • Child appropriately performs an action and names it to another (e.g. 'Look at my sand castle'). • Child invites another to join a game, with the view of doing something together (e.g. 'Do you want to play "dinosaur chase"') • Child initiates a conversation with a peer by asking a question, making a statement or indicating an interest in what the peer is doing/playing. For example, 'what are you doing?'; 'what football team do you support'?
<u>Non-verbal Recruitment</u>
<ul style="list-style-type: none"> • An attempt to engage another using a non-verbal gesture, such as beckoning, waving, pointing at a toy.
<u>Joins in</u>
<ul style="list-style-type: none"> • Child approaches a peer who is playing a game/ doing an activity and actively joins them in a collaborative fashion. This does not include a child going up and playing in parallel with a peer using the same apparatus (e.g. the swings), and it must be more than simply going to watch another peer. There must be some collaborative action or participation in conversation.
<u>Other Initiated Social Interactions</u>
Same events as described in self-initiated interactions but the initiation of the conversation/ game/ activity comes from the peer not the target child. To be counted as an interaction, the target child must respond in an appropriate way, either by giving a verbal response, a non-verbal response, or joining in collaboratively. Do not count adult interactions.
<u>Duration</u>
Press the 'S' button when target child initiates a social interaction themselves. Press the 'O' button when a peer initiates an interaction with the target child. Press buttons again when the interaction ends. The end of an interaction is indicated by a verbal termination of the conversation (e.g. 'see you later'), by physical termination of the interaction (e.g. child walks off) or by the activity ceasing to be collaborative (e.g. child starts playing their own game in close proximity to peer, but they are no longer interacting, playing or talking together).

significant increases or decreases in GARS-SI scores for any of the groups.

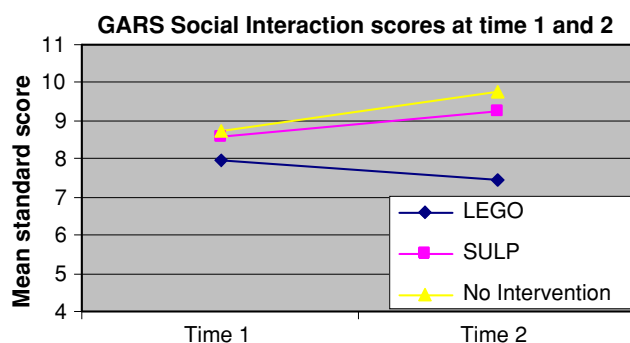
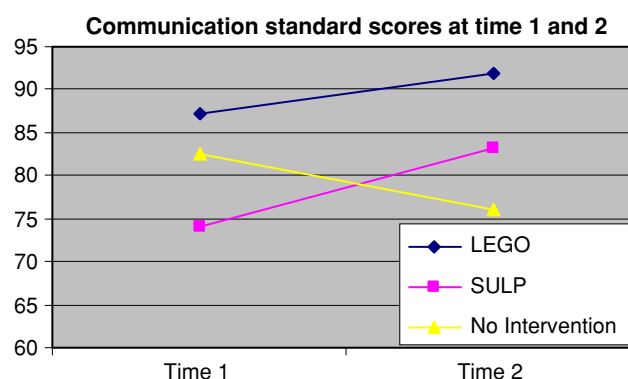
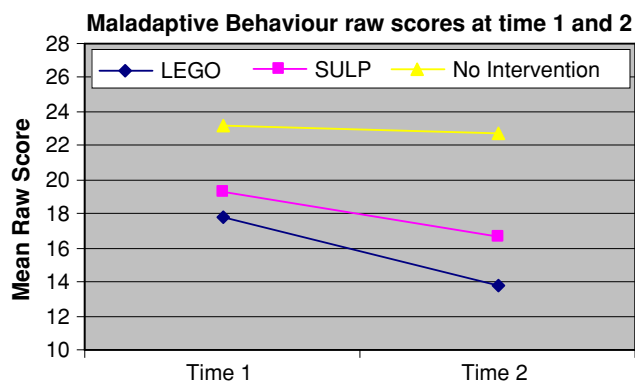
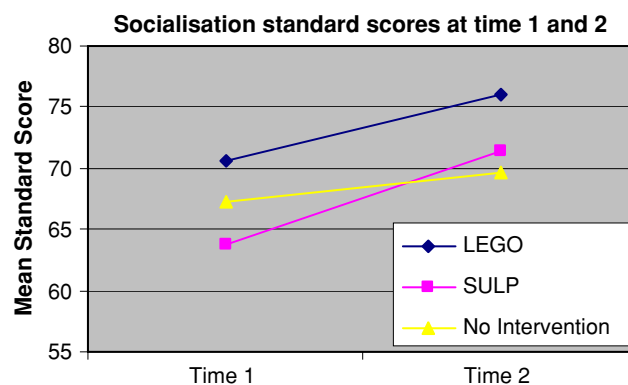
Figure 5 shows the change in the Maladaptive Behaviour scale of the VABS. The Kruskal–Wallis test showed no significant differences between the groups at time 1, though there was a trend for the control group to score higher. At time 2, there was a significant difference between the three groups; the LEGO and Sulp groups had less maladaptive behaviour than the no-intervention control group. Within-group analyses using the Wilcoxon Signed

Ranks test showed that the LEGO group improved significantly on this measure between time 1 and time 2 ($z = -2.16, p < 0.05, n\text{-ties} = 15$) whereas the other two groups did not.

Figure 6 shows the change in the communication scale of the VABS. There were no significant differences between the groups at time 1 or time 2; however, there was a trend for the intervention groups to improve when the control group deteriorated slightly. Within-group analyses using the Wilcoxon Signed Ranks test showed that the

Table 4 Mean scores on all outcome measures at time 1 and time 2

Outcome measure	LEGO		SULP		No-intervention	
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2
GARS-SI mean standard score (SD)	7.94 (2.70)	7.44 (2.20)	8.60 (2.97)	9.27 (2.66)	8.75 (2.91)	9.75 (3.36)
VABS socialisation mean standard score (SD)	70.56 (12.13)	75.94 (14.86)	63.73 (11.63)	71.33 (12.63)	67.19 (11.51)	69.69 (13.23)
VABS communication mean standard score (SD)	87.25 (14.89)	91.88 (18.83)	74.13 (18.47)	83.13 (16.34)	82.5 (23.94)	76.06 (17.17)
VABS maladaptive behaviour mean raw score (SD)	17.75 (9.43)	13.81 (5.23)	19.31 (7.89)	16.69 (5.79)	23.19 (6.15)	22.75 (5.52)
Mean frequency of self-initiated social interactions in seconds (SD)	9.09 (5.49)	8.81 (7.32)	8.40 (6.34)	7.20 (5.67)	N/A	N/A
Mean duration of social interactions in seconds (SD)	4.77 (2.25)	6.66 (3.54)	4.96 (2.30)	5.80 (2.30)	N/A	N/A

**Fig. 4** GARS-SI scores at time 1 and time 2**Fig. 6** Communication scores at time 1 and time 2**Fig. 5** Maladaptive behaviour scores at time 1 and time 2**Fig. 7** Socialisation scores at time 1 and time 2

SULP group improved significantly in communication ($z = -2.770$, $p < 0.01$, n -ties = 14) whereas the other groups did not.

Figure 7 shows the change in the socialisation scale of the VABS. Again, there were no significant differences between the groups at time 1 or time 2; however, there was a trend for the intervention groups to improve at a faster rate than the control group. Within group analyses using the Wilcoxon Signed Ranks test showed that the SULP group improved significantly in socialisation ($z = -2.27$, $p < 0.05$, n -ties = 15) whereas the other groups did not.

Direct Measures: Playground Observations

Ten minute playground observations were carried out in school for a subset of the participants in the LEGO and SULP groups ($n = 21$) to measure the frequency of self-initiated social interactions and the duration of all social interactions. There were no significant differences between the two groups at time 1 or time 2. However, Fig. 8 shows a trend for the LEGO group to improve more in the mean

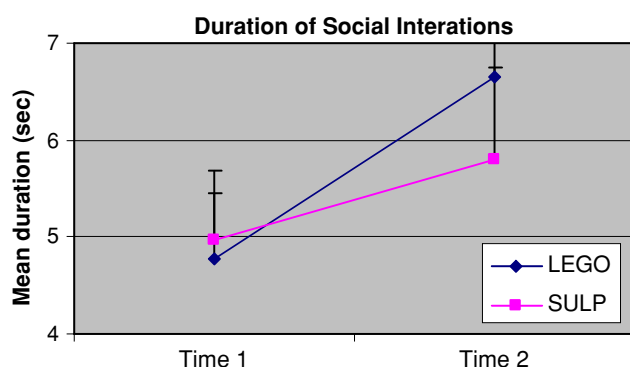


Fig. 8 Duration of social interactions at time 1 and time 2

duration of social interactions than the Sulp group and within-group analyses showed a significant increase in duration of interactions for the LEGO group ($z = -1.988$, $p < 0.05$, n -ties = 10) but not the Sulp group, though the magnitude of this change was small.

Child Enjoyment and Parent Satisfaction

There were no significant differences in parent satisfaction with the therapy between the two groups. Eleven out of 16 children in the LEGO group gave an enjoyment score of 10/10, whereas only 5 out of 15 children in the Sulp group gave 10/10, but the difference in mean scores was not significant between the groups.

Discussion

The aim of this study was to carry out an independent evaluation of the effectiveness of LEGO therapy and the Sulp as social skills interventions for 6–11 year olds with HFA/AS.

Autism-specific social difficulties (measured by the GARS social interaction subscale) reduced following LEGO therapy, in contrast to no change in the Sulp group or control group. The magnitude of this change was small, but is consistent with previous studies evaluating LEGO therapy (LeGoff 2004; LeGoff and Sherman 2006) and suggests that LEGO therapy may be more effective than Sulp at reducing autism-specific social difficulties.

The LEGO and Sulp groups both showed a reduction in maladaptive behaviour following intervention, and maladaptive behaviour scores for the two intervention groups were significantly lower than the no-intervention control group. This suggests that these two social skills interventions were effective in reducing maladaptive behaviours in children with autism. There was also a trend for both intervention groups to improve more on socialisation and communication (as measured by the Vineland

Adaptive Behaviour Scales) than the no-intervention control group, though there was no significant difference between the groups on these measures.

When examining change within each group separately, the LEGO group improved significantly on the maladaptive behaviour domain of the VABS while the Sulp group improved significantly on the communication and socialisation domains of the VABS and the no-intervention control group did not improve significantly. This suggests that the two interventions may target different types of behaviour. LEGO therapy might be more suitable for children with autism who have a lot of maladaptive behaviour, while Sulp may be suitable for children with social and communication difficulties. This is simply a suggestion, however, as there were no significant differences between the Sulp and LEGO groups following intervention. Perhaps these within-group differences would become significant between group differences with a larger sample size and/or longer intervention period. Future research should examine this.

In the direct observations of social behaviour in the school playground, the LEGO therapy group showed a small yet statistically significant increase in the duration of social interactions while the Sulp group did not. This suggests some generalisation of skills in the LEGO group, consistent with previous research; however, this change did not result in significant differences between the two therapy groups after intervention and was very small in magnitude. There was no difference in the number of self-initiated social interactions in the LEGO or Sulp group. Unfortunately, there were no direct observational data available for the no-intervention control group. There are also several limitations to this outcome measure. Firstly, the results may have been subject to bias, as the researcher was not blind to group allocation. The duration of the observations was only 10 min, which may not have been sufficient to measure variability in the duration of interactions among participants. Results from this measure should be interpreted with caution, and future studies should carry out longer, blind observations of playground behaviour.

Both LEGO therapy and Sulp have the potential benefit of helping children with autism improve in their social behaviour and are better than no intervention at all. It would be interesting to isolate the specific elements of these interventions that are effective. It would also be of interest to evaluate whether any collaborative play or social communication teaching approach has similar efficacy to LEGO therapy and Sulp. Future research should investigate this. Neither LEGO therapy or Sulp require much time or financial commitment and can be easily set up by teachers or clinicians. Children who attend mainstream school yet require additional support for social skills might

benefit greatly from just a small amount of extra intervention. A manual for Sulp is available and Sulp training courses happen regularly in the UK. Lego therapy is clearly described in LeGoff's original study (LeGoff 2004). The potential for using these approaches in classrooms and after-school groups is large and should be evaluated further.

There were several limitations to this study. Firstly, participants in the no-intervention control group were not randomly assigned and there were no direct observational data available for this group. Ideally, all participants would be randomly assigned to the Lego, Sulp or no intervention groups and future studies should address this. Secondly, the GARS-SI and VABS were completed by parents who were aware of the type of intervention their child was receiving, so results could have been subject to bias due to parental expectations. However, data for the no-intervention control group were collected as part of a different study looking at the development of social skills over time. Parents in this group were therefore unaware at the time of data collection that their children were part of a no-intervention group, and so were less likely to be biased in this respect. For the Lego and Sulp groups, the parent satisfaction questionnaire suggests that parents were not biased in terms of their satisfaction with therapy as both groups of parents were equally satisfied with the therapy their children received. There may have been a difference in affective enjoyment between the two intervention groups, as more children in the Lego group rated their enjoyment as high than children in the Sulp group. This may have had an impact on the effectiveness of the interventions, and this should be evaluated in future studies.

A further issue is that the researcher in this study was also the person running both interventions. While this kept the therapist consistent across interventions, it may have added bias because the therapist was aware of the research hypotheses. There were also no treatment fidelity measures taken. As a result, it cannot be certain whether the interventions were carried out correctly in a standardised fashion, as was intended. This means that it cannot be certain whether any gains seen after intervention were a result of the intervention as intended or a result of different aspects that may have been added accidentally. Despite this, the researcher was equally well-trained in both intervention techniques, and equal effort was put into the preparation of both interventions. It is hoped that the interventions were carried out appropriately, though future research will be necessary to confirm that the interventions as described are effective. Parents were also equally satisfied with the therapy, suggesting that both types of intervention were carried out with equal effort and skill. Undergraduate helpers were used instead of trained

professionals, which may have affected the efficacy of the interventions. However, the principal therapist was the first author who was adequately qualified to carry out both interventions and guided the undergraduate helpers in each session.

The sample size here was small, and the characteristics of children who dropped out of the study were not taken into account so findings need to be replicated and extended. It is also important to follow-up the children after the end of the interventions to see if any gains were maintained over a longer time period.

Despite the many methodological limitations of this study, the results for Lego therapy and Sulp are encouraging. This study independently replicates previous findings that Lego therapy is a promising intervention for children with HFA and AS and is the first evaluation of Sulp for children with HFA and AS. The next stage should be a large-scale randomised control trial that addresses all the methodological issues mentioned previously and that includes long-term follow-up data. If these findings remain positive, then these approaches could be used in schools and clinic settings to make them widely accessible to the community.

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