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Functional Analysis of Contextually Inappropriate Social Behavior in Children With Down Syndrome

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Abstract

Background: Children with Down syndrome often engage in contextually inappropriate social behavior, which researchers suggest may function to escape from difficult activities to preferred social interactions. Caregivers may reinforce the behavior, perceiving it only as evidence of the child's social strength, when, in fact, the pattern may also prevent or slow the development of critical skills. Unlike overt forms of challenging behavior, contextually inappropriate social behavior had never been subjected to experimental analysis.

Aims: The purpose of the current study was to identify and demonstrate functional control of contextually inappropriate social behavior to caregiver-informed contingencies.

Method and Procedures: We interviewed caregivers and subjected contextually inappropriate social behavior to functional analyses for nine young children with Down syndrome.

Outcomes and Results: We found sensitivity to the caregiver-informed contingencies for all nine participants with strong functional control and large effect sizes for most.

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Conclusions and Implications: Caregivers may not perceive contextually inappropriate social behavior as problematic, yet patterns of contextually inappropriate and other problem behaviors suggest decreased engagement and poor task persistence. Assessments that lead to intervention decisions may be more informative when they include questions about social topographies of behavior not typically considered as problematic. Once caregivers are aware of the pattern, they may be better prepared to intervene.

Keywords
developmental gap, Down syndrome, functional analysis, contextually inappropriate behavior, social behavior

What this paper adds

The application of functional analysis to topographically social behaviors not typically considered to be problematic provides insight into the learning styles of young children with Down syndrome. Our study demonstrates with nine participants that contextually inappropriate social behavior in Down syndrome was maintained by caregiver contingencies and that the pattern may interfere with learning. When problem behavior takes unexpected forms, caregivers, who present many learning opportunities when their children are young need to be aware of how this can impact development.

Social behavior is often considered a strength in young children with Down syndrome who show interest in and preference for social interaction and social games (Fidler, 2006). But social behavior may not always be appropriate and, in fact, could sometimes be part of a nuanced pattern of problematic behavior. Beginning in infancy, children with Down syndrome show inconsistent patterns of engagement, sometimes avoiding and even refusing to engage in learning opportunities, preventing the development of critical skills (Fidler, 2005, Fider, Most, & Booth-LaForce et al., 2006, Fidler, Most, Booth-LaForce et al., 2008; Filder, Most, & Philofsky, 2008; Wishart & Manning 1996; Wishart & Duffy, 1990). When children do not follow instructions, are slow to respond, and/or engage in interfering behaviors such as refusal, this has been referred to as noncompliance (Kalb & Loeber, 2003; Lipschultz & Wilder, 2017; Mace et al., 1988; Shriver & Allen, 1997) and more recently, noncooperation (Rajaraman et al., 2022). And in many children, noncooperation may take the form of tantrums, aggression, self-injury, elopement, property destruction, or other topographies that are overtly problematic (Hanley et al., 2003). But there is a more nuanced pattern of

topographies of refusal or noncooperation in children with Down syndrome that has been described as "opting out" (Wishart, 1993, p. 51) or "switching out" (Wishart, 1993, p. 50). In fact, the pattern of noncooperation often involves behaviors described as "social" and "charming" (Wishart, 1993, p. 51) because the topographies (e.g., smiling, laughing, hugging, tilting head to the side) are those that are typically associated with positive rather than negative social consequences (Pitcairn & Wishart, 1994; Wishart, 1993, 2001).

Wishart (1993) refers to the pattern of refusal observed in children with Down syndrome as a "misuse of social behavior" (p. 51) and we refer to it as contextually inappropriate social behavior because the behavior tends to occur, like more overt topographies of problem behavior, when the child with Down syndrome is asked to engage in an activity (Carvajal & Iglesias, 2000; Fidler, 2005, 2006; Kasari & Freeman, 2001). In contrast to the overt topographies, however, contextually inappropriate social behaviors may be difficult to identify as noncooperation, though both may indicate poor task persistence and interfere with learning.

Though seemingly not topographically "problematic," contextually inappropriate social behaviors may have the same negative effects on learning that other forms of noncooperation do including failure to engage in learning opportunities sufficiently to master critical skills. If caregivers are not aware of the pattern of contextually inappropriate social behavior as it emerges, it may persist and not only interfere with opportunities to learn (Doss & Reichle, 1991), but contribute from an early age to the establishment of a problematic learning style that has far-reaching negative consequences (Robertson, 2015; Sellinger & Hodapp, 2005; Wishart, 1993, 2001; Wishart & Duffy, 1990). The pattern may contribute to the exponentially widening developmental gap between individuals with Down syndrome and their typically developing peers during early childhood.

Wishart (1993) suggests that children with Down syndrome employ their savvy social skills to avoid tasks in favor of social interactions with the caregiver. When a caregiver places a toy in front of the child with Down syndrome and asks the child to play with it, more so than follow directions or play with the toy, the child may look at the caregiver, smile and laugh, and/or enthusiastically switch to an easier or more social activity. While the behavior may seem playful, it is not relevant to the activity the caregiver presented. One concern about contextually inappropriate social behavior is that the topographies might not raise red flags for caregivers who present many learning opportunities during everyday activities when their children are young. Caregivers may perceive social behavior only as a strength and overlook how it can also be problematic when it occurs non-contextually (Fidler, 2005; Fidler, Most, & Philofsky, 2008; Hodapp, 1997; Hodapp, Ricci, Ly, & Fidler,

2003; Wishart, 1993). When a child with Down syndrome consistently engages in a contextually inappropriate behavior in response to a task and the topography is social or pleasant, the caregiver may inadvertently provide reinforcing consequences that maintain the behavior. The caregiver may naturally attend to the social behavior, may shorten the activity by requiring "just one more response," or may abandon the task altogether, allowing the child to switch to a different, perhaps easier, activity or social interaction. While the child may engage in some contextual behavior related to the activity, often they will not remain engaged long enough to acquire critical skills and may even resist the task if revisited later (Fidler, 2005; Pitcairn & Wishart, 1994; Wishart, 1993, 2001; Wishart & Duffy, 1990). Each time the child's smiling and laughing in an inappropriate context are reinforced with attention and termination of the activity, the pattern may strengthen. Rather than lead to new reinforcers, learning environments, contingencies, and related positive behaviors as many newly learned skills in young children do (Bosch & Fuqua, 2001; Rosales-Ruiz & Baer, 1997), in some contexts, the social behavior may serve only to escape from adult-led activities to familiar or preferred caregiver interactions (Fidler, 2005; Wishart,1993).

While contextually inappropriate social behavior has been consistently described as one suggestive of persistent escape motivated behavior, even referred to as a "motivational deficit" (Wishart, 2001, p. 49), this pattern in very young children with Down syndrome has never been subjected to experimental analysis. Functional analysis may reveal sensitivity to consequences such as escape and attention. In each activity with the caregiver, presumably, attention is available to the child throughout. The child may prefer a specific form of attention or one that is not generally available for engaging in contextual behaviors. The contextually inappropriate social topographies of behavior may also be precursors to more severe problem behavior or may be more likely to contact reinforcing consequences than overt topographies of problem behavior. For example, for young children with Down syndrome, smiling while not engaging in an activity might be more likely to contact reinforcement than explicitly refusing to engage by saying, "no." Functional analysis may also result in better understanding about the specific types of activities young children with Down syndrome tend to avoid. For example, young children may avoid difficult activities related to areas of relative weakness (e.g., expressive communication, fine motor tasks) or may avoid activities they have done before (Fidler, 2005; Wishart, 1993).

The purpose of the current study was to identify contextually inappropriate social behavior and to demonstrate functional control and sensitivity of the contextually inappropriate social behavior to caregiver-informed contingencies assessed during a functional analysis. We examined contextually

inappropriate social behaviors that occurred during activities identified by caregivers in young children with Down syndrome by systematically evaluating environmental variables likely to be maintaining those behaviors. We also measured the extent to which problem behaviors occurred during the same situations. Caregivers participated in the functional analysis to (a) determine how caregivers perceived contextually inappropriate social behavior, (b) examine as natural a contingency as possible with relevant stakeholders, and (c) demonstrate how social behavior may also interfere with learning.

Method

Participants and Setting

The first nine consecutive children with Down syndrome and their caregivers who expressed interest participated in this study. The children who participated were between the ages of 2 and 6 years and included five boys and four girls (see Table 1). To be included, the child and caregiver needed to be available together for one to three visits of up to 3 hr each visit. We recruited at local events for families of children with Down syndrome and by word of mouth. To identify topographies of contextually inappropriate social behavior as Wishart (1993) and others have described and analyze them functionally, we sought children with Down syndrome between the ages of 1 and 6 "who love to be social." This project was approved by the Queens College Institutional Review Board. All sessions took place in the family's homes and were completed in one or two visits of up to 3 hr each. Caregivers provided informed consent and verbally confirmed the diagnosis of Down syndrome. Brandon (5) was the only participant who also had a diagnosis of Autism Spectrum Disorder (ASD).

Dependent Measures

The primary dependent measure was the percentage of 10-s intervals during which a contextually inappropriate social behavior occurred during each test and control session. Although not subjected to the contingencies arranged during the functional analysis, we also examined the percentage of 10-s intervals during which some other problem behavior occurred. We video recorded sessions for later coding, interobserver agreement, and procedural integrity. We did not consider contextually inappropriate behavior and other problem behavior to be mutually exclusive. That is, both could occur with the same 10-s interval, and they would have been scored. Furthermore, this infers that the sum of both measures could be greater than 100%.

Table 1. Participant Characteristics.

Participant	Age	Communication	Contextually inappropriate social behavior
Elaina	6	Words Simple sign	Smiles, grimaces Says, "you do it/eat it." Switches activities Talks about switching activities
Heidi	6	Full sentences	Switches activities Talks about switching activities Changes topic Asks why
Rebekah	5	Words/Phrases Full sentences Poor intelligibility	Switches activities Talks about switching activities Smiles and laughs Says activity is "tricky."
Brandon	5	No speech Leads hand Communication board	Smiles Hugs caregiver Tilts head to the side Non-speech sounds
Haleigh	4	No speech Points Simple sign	Climbs in caregiver's lap, hugs Laughing Switches activities Talks about switching activities Climbs in bed/covers up
Tristan	4	1–2 word phrases	Laughing Switches activities Talks about switching activities Answers incorrectly to known questions Bruxism Non-speech sounds (humming)
Enzo	2	Body language One word, "mama."	Hugs caregiver Smiles, grimaces, tilts head to side Blows raspberries Social game (rocking) Switches activities Non-speech sounds Kisses toy Foot in the air
Spencer	2	Simple sign Pointing Words "yeah," "Dada"	Arms crossed/head tilted Head down to the floor Feet in the air/on table Switches activities
Yusuf	2	Single words Gesture Standing near	Sucks thumb Smiles, makes faces Climbs in caregiver's lap, hugs Waves to toy

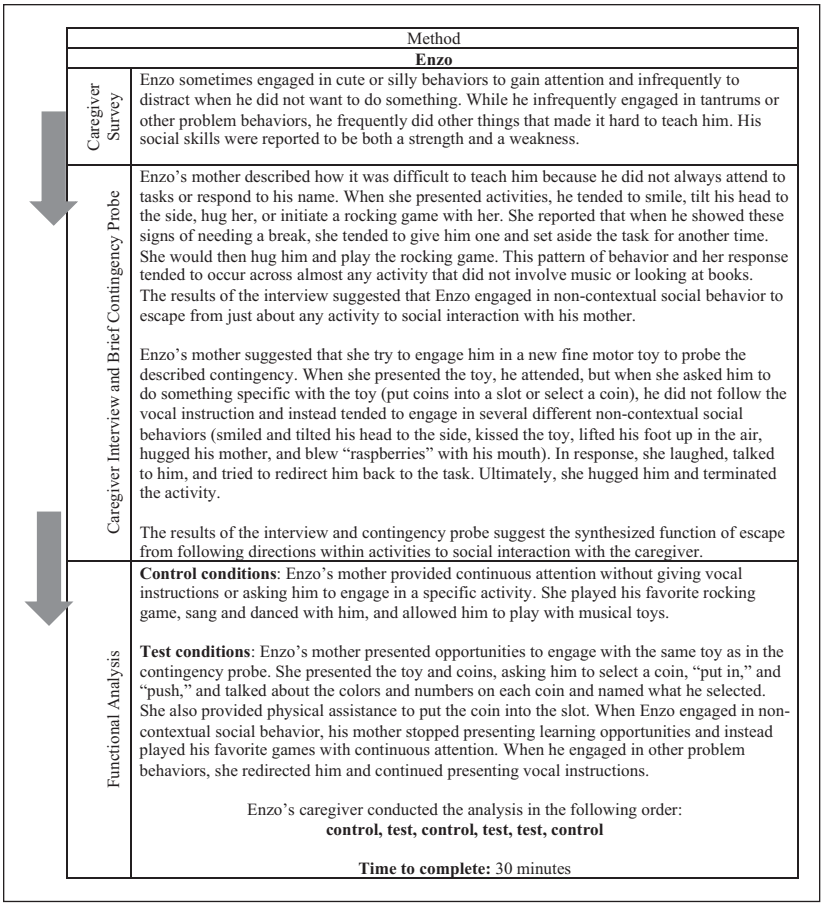

Figure 1. Functional analysis method for 2-year-old Enzo.

Caregivers identified contextually inappropriate social behaviors (See Table 1, Figure 1) and the situations in which they tended to occur before the functional analysis (See Table 2). We defined contextually inappropriate social behavior as any behavior unrelated to the present activity or opportunity, not overtly problematic, and occurred while orienting toward or making eye contact with the caregiver (e.g., hugging the caregiver, tilting head to the side, grimacing). We selected for the assessment, the contextually inappropriate social behavior(s), as defined here, that were reported and/or observed to occur most frequently. It is important to point out that caregivers played a

Table 2. Procedure Characteristics.

	Session duration (min)	Total analysis duration (min)	Caregiver-informed contingency
Elaina	3, 4, 5	23	Escape from following directions within difficult activities to caregiver attention.
Heidi	5	30	Escape from following directions within activities to caregiver attention.
Rebekah	5	40	Escape from following directions within difficult activities to caregiver attention.
Brandon	5	30	Escape from difficult activities to caregiver attention.
Haleigh	5	30	Escape from following directions within difficult activities to caregiver attention.
Tristan	5	30	Escape from difficult activities to caregiver attention and preferred activities.
Enzo	5	30	Escape from following directions within activities to caregiver attention.
Spencer	5	30	Escape from difficult activities to caregiver attention.
Yusef	5	25	Escape from following directions within difficult activities to caregiver attention and preferred activities.

Note. Two test sessions for Elaina were terminated early (3 and 4 min) due to the intensity of her problem behavior.

direct role in informing what behaviors were considered contextually inappropriate and not overtly problematic to them in their individualized situations. On some rare occasions this may have included topographies often determined to be problematic, such as bruxism (Tristan) or putting their feet on the table (Spencer); however, we included those as contextually inappropriate when caregivers specified that they were exhibited in a playful manner, while making eye contact.

We also identified other problem behaviors. Other problem behaviors included those during which the child was not orienting to the caregiver or making eye contact (e.g., bruxism or making other non-speech sounds while

not orienting to or looking at the caregiver) and those that were overtly problematic (e.g., crying, hitting, eloping). For each participant, we identified more than one contextually inappropriate social behavior and problem behavior.

Experimental Design and Data Analysis

We used a multielement design within a series of consecutive cases to examine contextually inappropriate social behaviors during test and control sessions in the functional analysis. While only putative reinforcers respective to contextually inappropriate social behavior were experimentally manipulated during the functional analysis, other problem behaviors were also measured. Functional control was examined by calculating three different measures.

The percentage of non-overlapping data (PND; Scruggs et al., 1987) indicated the percentage of data points in the test session that fell below the highest data point in the control session. Scruggs et al. (1987) suggest that a PND value between 90% and 100% indicates a large effect, a value between 70% and 90% a fair effect, a value between 50% and 70% a questionable effect, and anything below a 50% an unreliable effect. We also subjected the data to the binary structured criteria (BSC) developed by Hagopian et al. (1997) and modified by Roane et al. (2013) for sessions with short durations (i.e., 3–5 min). With data from the control session, the BSC established an upper criterion line one standard deviation above the mean percentage of intervals with the behavior and a lower criterion line one standard deviation below the mean. The number of data points in the test session that fell above the upper criterion line minus the number that fell below the lower criterion line divided by the total number of data points was calculated and converted to a percentage. Roane et al. (2013) suggests percentages greater than 50% show differentiation and functional control. The multilevel structured criteria (Jessel et al., 2020) examined the extent to which the data overlapped and whether the behavior was observed in the control session. PND at 100%, showing no overlap, and no behavior in the control session indicated strong functional control. Any overlap between the test and control conditions *or* behavior observed during the control condition would indicate a moderate level of control. Overlapping data (i.e., PND $< 100\%$) and behavior observed in the control session indicated a weak level of control.

Procedure

Prior to the functional analysis, we conducted a survey with the caregivers regarding their perception of their child's behavior. In addition, we conducted an open-ended interview with the caregivers and a brief contingency probe

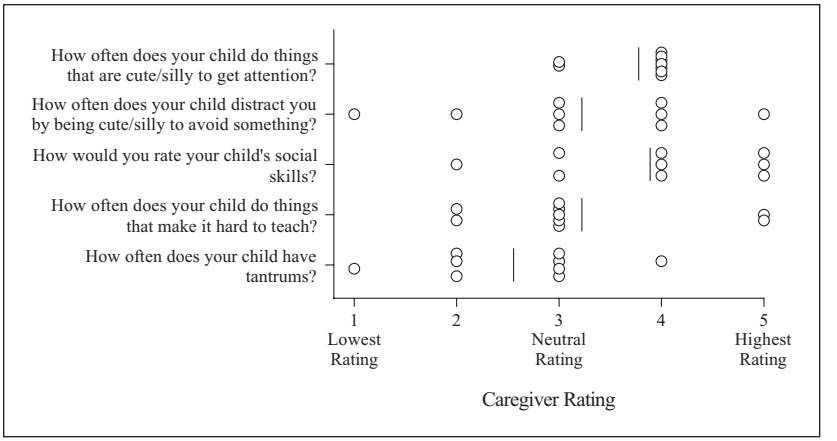

Figure 2. Caregiver perception survey.
Note. Symbols represent each caregiver rating. Vertical line represents the mean. Questions are abbreviated.

with the children to inform the design of the functional analysis procedures. Figure 1 shows an example of all the assessment process steps for one participant, Enzo, which we further described in greater detail.

Caregiver Perception Survey. Caregivers responded to a five-question survey (See Figure 2) about their child's behavior. The five questions asked caregivers about their perceptions of their child's social skills and problem behavior and the extent to which they attributed challenges teaching their child to their child's behavior. Enzo's mother reported that he sometimes did cute or silly things to gain her attention and infrequently to distract her when he did not want to do something. While he infrequently engaged in tantrums or other problem behaviors, he frequently did other things that made it hard to teach him. His mother reported his social skills as both a weakness and a strength.

Caregiver Open-Ended Interview and Brief Contingency Probe With Child. Caregivers helped to identify the topographies of contextually inappropriate social behavior(s), antecedents, and consequences related to the contextually inappropriate social behaviors during the open-ended interview (Supplemental Material). The questions were similar to those described in the Appendix of Hanley (2012). Caregivers described the topographies of their children's social behavior. Enzo's mother, for example, described how he smiled and tilted his head to the side, hugged her, and initiated a game that involved

holding her hands and rocking back and forth. Skills that were difficult for the children to learn included fine and gross motor activities, daily living skills, and/or communication. Sometimes social behaviors occurred during relevant social situations, such as smiling, hugging, and saying "hi" when greeting others, suggesting social behaviors were contextual. However, caregivers also described those behaviors as sometimes occurring during other activities. For example, smiling, hugging, and saying "I love you" when asked to do a puzzle. Enzo's mother said that it was challenging to teach him something because he did not always attend to the activity or respond to his name. She said the contextually inappropriate social behaviors usually indicated that he needed a break. When the topography of the social behavior did not match the context in which it was reported to occur, primarily if it occurred in response to an adult's direction to engage in an activity as described by Wishart (1993), it was suspected to meet the definition of contextually inappropriate social behavior.

Responses to their children's social behaviors included delivering attention and/or terminating the non-preferred activity following the behavior. For example, in response to his social behavior, Enzo's mother said she might give him a break and play his favorite rocking game. For all participants, caregiver descriptions suggested that social behavior occurred out of context during difficult/challenging activities. When more than one context or activity was identified, caregivers suggested which were most likely to evoke contextually inappropriate social behavior.

We then briefly probed the contingencies by asking caregivers to show us the situations they had just described. The purpose was to gather more information to help design the functional analysis, such as identifying additional topographies of contextually inappropriate social behavior, establishing operations, and associated consequences (Jessel et al., 2020). Caregivers presented learning opportunities, interacted with, and responded to the child as they typically would. For all participants, the establishing operations identified involved asking the child to engage in an activity. For most participants, this was a fine motor activity. For some participants, caregiver vocal instructions within the activity also seemed to occasion the contextually inappropriate behavior. For example, Enzo's mother selected a new fine motor toy that involved putting coins into a slot. When Enzo's mother asked him to put coins in, he engaged in several topographies of contextually inappropriate social behavior. He smiled and tilted his head, hugged his mother, kissed the toy, lifted his foot in the air, and "blew raspberries" with his mouth.

Table 1 shows the contextually inappropriate social behaviors we identified during the caregiver interview and brief contingency probe for each participant. The contextually inappropriate social behaviors varied from participant

to participant; however, some behaviors occurred across several participants. Seven participants switched or talked about switching activities when the caregiver presented the activity. Seven participants smiled and/or laughed. Three hugged the caregiver or made non-speech sounds, and two tilted their heads to the side. We selected the topographies that met the definition of contextually inappropriate social behavior and occurred most frequently to target during the functional analysis.

From the caregiver interviews and brief contingency probes, we noted that the caregiver-delivered consequences involved some form of attention and either termination or delay of the activity. Delays in the activity usually occurred while the caregiver delivered attention or otherwise responded to the contextually inappropriate social behavior. Sometimes caregivers also allowed the child to switch to an activity of their choosing. For example, Enzo's mother laughed, talked to him, tried to redirect him back to the task but could not, and eventually hugged him and terminated the activity. The hypothesized reinforcement contingencies for each participant are presented in Table 2.

Functional Analysis. We then designed the functional analysis for each child with control and test conditions informed by the information gathered from the caregivers (Hanley et al., 2014; Jessel et al., 2016). To teach the caregiver to implement the functional analysis with their child, we first vocally described the procedures. When offered, five caregivers asked that we also model and practice how to deliver planned antecedents and planned consequences contingent on the identified contextually inappropriate social behaviors (following a typical behavioral skills training approach; Sarokoff & Sturmey, 2004). Training lasted 5 to 10 min ($M = 7$ min). For all caregivers, we provided in vivo coaching (with prompting, praise, and corrective feedback as needed) during the functional analysis.

The functional analysis involved at least five sessions, each lasting 5 min with a break of at least 2 min between each session. Each session reflected either the test or control conditions. All caregivers presented a control session first. During the control condition, the caregiver did not expose the child to the evocative activities and instead continuously delivered all the suspected reinforcers. After the first control session, the caregiver presented a test session.

During the test condition, the caregiver presented at least one of the evocative activities with vocal instructions. When there was more than one specific activity, opportunities for each were incorporated. Some caregivers also provided additional assistance, such as vocal, gestural, or physical response prompts as they would naturally. The caregiver then delivered all the implicated reinforcing consequences for approximately 30 s, contingent on the

contextually inappropriate social behaviors. This included terminating the activity and delivering caregiver attention (e.g., smiling and laughing). For some participants, reinforcement also included tangible items. After each 30-s delivery of reinforcement, the caregiver presented the activity and the instruction again. The caregiver repeated this process until the end of the session. The caregiver continued to present test and control sessions thereafter until at least three test sessions and two control sessions had been presented. We terminated two test sessions for Elaina early (3 and 4 min) due to the intensity of her problem behavior.

Social Validity

Caregivers completed a six-question social validity survey (See Figure 6) about their experience with the assessment process following the completion of the functional analysis. The social validity survey included six questions on a Likert scale from 1 to 5, where 1 indicated that the caregiver disagreed with the statement and 5 indicated agreement. In addition, caregivers rated the change in their understanding of their child's strengths and weaknesses following the analysis and whether they would interact differently with their child. We were specifically interested in whether caregivers now recognize how social behavior occurs inappropriately in some contexts.

Interobserver Agreement

A research assistant coded all videos by watching session recordings and marking data into an electronic data sheet. To examine interobserver agreement (IOA) for all contextually inappropriate social and other problem behaviors, the first author coded 30% of all test and control sessions for all participants. We performed a variation of total count IOA by calculating the percentage of agreement between the research assistants and the first author's data. We divided the smaller percentage of 10-s intervals during which a behavior occurred in a session by the larger percentage of 10-s intervals during which a behavior occurred in that session and multiplying by 100. The first author and research assistant reviewed video recordings for any intervals with disagreements and resolved discrepancies.

For Elaina, Heidi, Rebekah, Haleigh, Tristan, and Enzo, IOA for both measures in the control session was 100%. For Brandon, IOA in the control session was 100% for contextually inappropriate social and other problem behavior. For Spencer, IOA in the control session was 94% for contextually inappropriate social behavior and 100% for other problem behavior. For Yusef, IOA in the control session was 100% for contextually inappropriate

social and other problem behavior. For Elaina, Heidi, Brandon, Haleigh, Tristan, Enzo, Spencer, and Yusef, IOA was 100% for both measures in the test session. For Rebekah, IOA was 100% for contextually inappropriate social behavior and other problem behavior in the test session.

Procedural Integrity

A research assistant examined procedural integrity for 33% of all surveys, interviews, probes, and caregiver training as well as 33% of all test and control sessions, which were implemented by the caregiver. We calculated the percentage of correctly implemented steps by dividing the number of correctly implemented steps by the total number of steps and then multiplying by 100. For all steps in the survey, interviews, probes, and caregiver training, integrity was 100%. For all steps implemented by the caregiver in the test and control sessions, integrity was also 100%.

Results

Functional Analysis

Each family participated in 5 to 8 ($M=6$) total sessions (test and control). The analysis took an average of 30 min (range, 23–40 min; see Table 2). Figures 3 and 4 display the percentage of 10-s intervals with contextually inappropriate social behavior and other problem behaviors for each participant. Figure 5 summarizes the mean proportions of contextually inappropriate social and other problem behavior across all test and control sessions. Table 3 shows the values for PND, BSC, and Multi-level Structured Criteria used to evaluate functional control of contextually inappropriate social behavior for each participant.

Contextually Inappropriate Social Behavior. The results of the functional analyses are presented in Figure 3 for nine participants. Across participants, the percentage of intervals with contextually inappropriate social behavior was greater in the test sessions ($M=42\%$, $SD=25.8$) than the control sessions ($M=4.3\%$, $SD=10.5$), $t(8)=6.55$, $p=.000178$ (See Figure 5). All nine participants showed sensitivity to the caregiver-informed reinforcement for contextually inappropriate social behavior. All participants reliably displayed elevated rates of contextually inappropriate social behavior during the test conditions. For most participants, there was no overlap between test and control conditions. Three functional analyses were identified as having strong functional control, three functional analyses had moderate functional control,

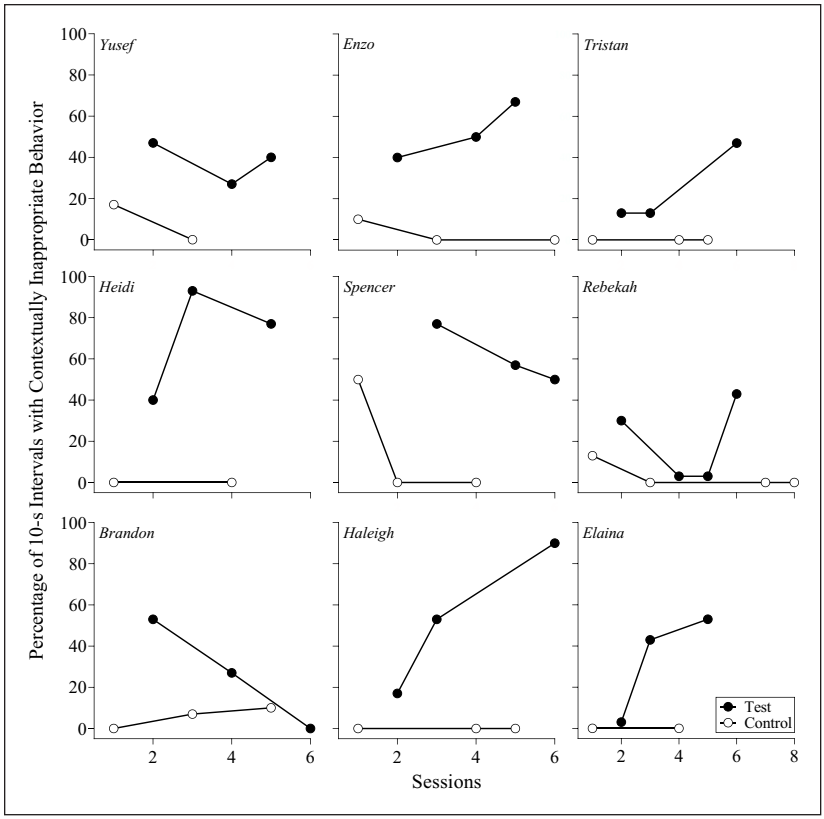

Figure 3. Contextually inappropriate behavior during the functional analysis.

and three had weak control. Haleigh and Tristan did not engage in contextually inappropriate social behavior at all during the control sessions, displaying the strongest values across all three measures of functional control and demonstrating consistent differentiation between the test and control sessions. Heidi, Enzo, and Yusef demonstrated differentiation with the strongest values in the PND and BSC and moderate levels in the Multilevel Structured Criteria. Elaina showed the strongest levels of functional control in the PND and Multilevel Structured Criteria with BSC also demonstrating control (67%). Spencer and Rebekah showed the best differentiation with the BSC (100% and 50% respectively). Brandon's highest measure of functional control (67% PND) suggested that functional control was questionable.

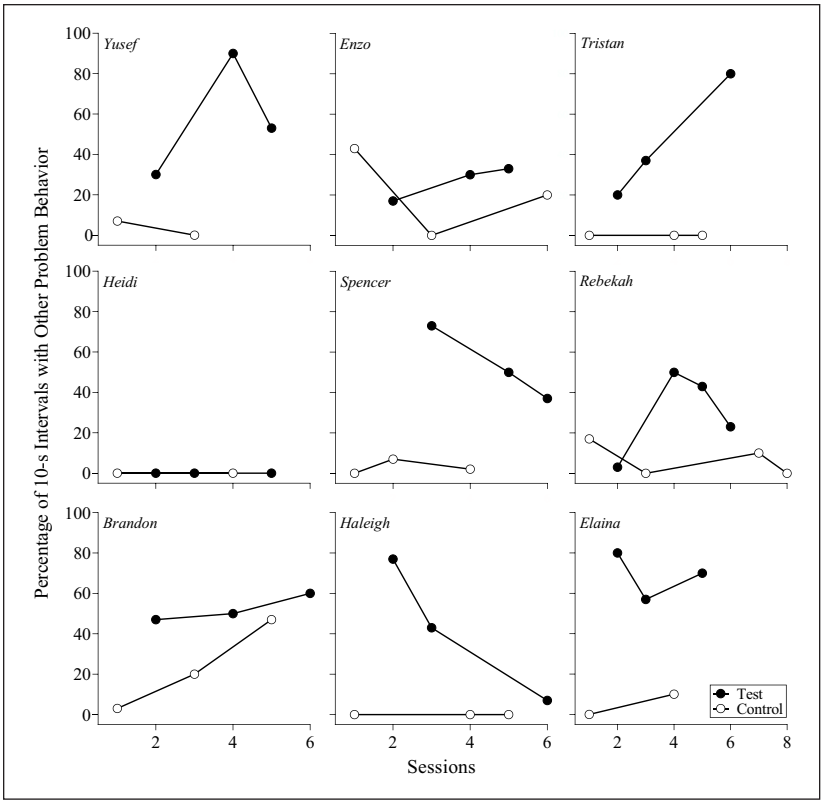

Figure 4. Other problem behavior during the functional analysis.

Other Problem Behavior. The overall pattern of other problem behavior observed was similar to that for contextually inappropriate social behavior. The percentage of intervals with problem behavior was greater in the test sessions (M=42%, SD=26.5) than in the control sessions (M=7.7%, SD=12.8), $t(8)=4.61$, $p=.001733$ (See Figure 5). We observed trends in problem behavior across test sessions. For example, the problem behavior exhibited by Tristan, Enzo, and Yusef displayed increasing trends across test sessions, whereas the problem behavior of Rebekah, Haleigh, and Spencer displayed decreasing trends. Elaina, Heidi, and Brandon had more stable rates of problem behavior across test sessions. We also observed related trends in problem behavior and contextually inappropriate social behavior. Heidi, Rebekah, Brandon, Haleigh, and Yusef showed inverse patterns of

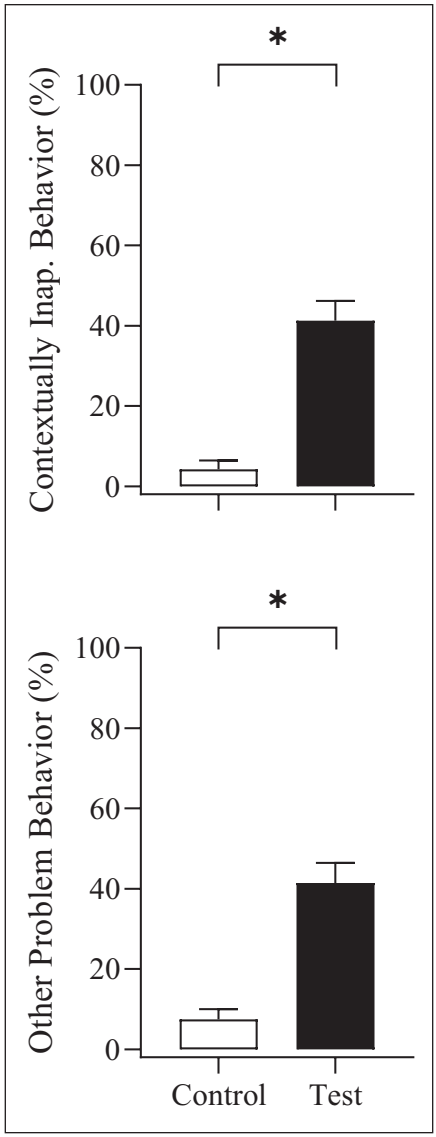

Figure 5. Summary of mean proportions of contextually inappropriate behavior and other problem behavior.

Note. Bars represent standard error measurement. Asterisks indicate statistically significant differences ($p < .01$).

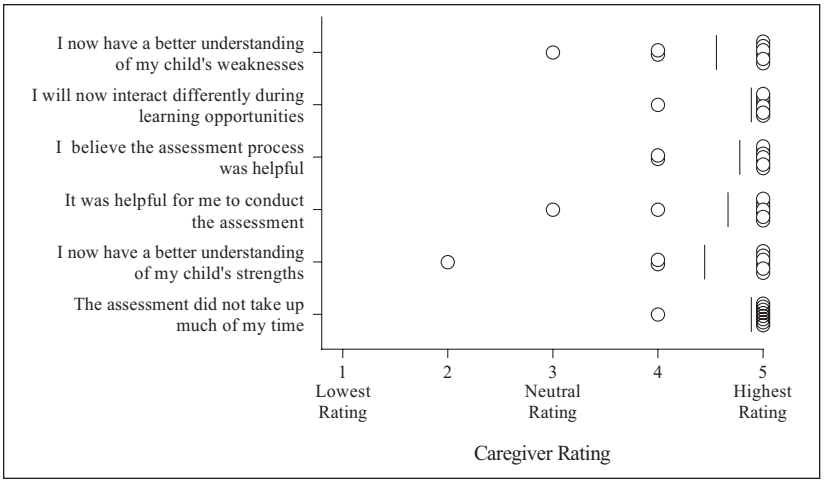

Figure 6. Social validity outcomes.
Note. Symbols represent each caregiver rating. Vertical lines represent the mean. Questions are abbreviated.

Table 3. Structured Criteria for Evaluating Functional Control of Contextually Inappropriate Social Behavior.

Participants	Percent of non-overlapping data	Binary structured criteria	Multi-level structured criteria
Haleigh (4)	100**	100	Strong
Enzo (2)	100**	100	Moderate
Heidi (6)	100**	100	Moderate
Tristan (4)	100**	100	Strong
Elaina (6)	100**	67	Strong
Yusef (2)	100**	100	Moderate
Spencer (2)	67	100	Weak
Rebekah (5)	50	50	Weak
Brandon (5)	67	33	Weak

Note. Numbers inside parentheses indicate the participant's age. Two asterisks indicate a large effect size using PND.

contextually inappropriate social behavior and other problem behaviors (i.e., when contextually inappropriate social behavior occurred in low proportions, other problem behaviors occurred in high proportions). There was

a direct relation between the contextually inappropriate social behavior and other problem behavior for Tristan, Enzo, and Spencer. For Tristan and Enzo, there was an increasing trend for both behaviors across test sessions. For Spencer, there was a decreasing trend for both.

Social Validity. Figure 6 depicts the results of the social validity survey that caregivers completed after the functional analysis. All caregivers agreed that, because of the assessment process, they would interact differently with their child during learning opportunities ($M = 4.9$, range, 4–5), and that the assessment process was helpful in general ($M = 4.8$, range, 4–5) and did not take up much of their time ($M = 4.9$, range, 4–5). Most caregivers (7 of 9) rated similarly the remaining questions, reporting that the analysis was helpful, and they now had a better understanding of their child's strengths and weaknesses.

Discussion

Up until now, contextually inappropriate social behavior in children with Down syndrome had only been described in the literature (Carvajal & Iglesias, 2000; Fidler, 2005, 2006; Kasari & Freeman, 2001; Pitcairn & Wishart, 1994; Wishart, 1993; Wishart & Duffy, 1990) and, although functions had been hypothesized, there had been no experimental examination of this pattern of social behavior. In the current study, we applied a functional analysis methodology for the first time, to the investigation of traditionally social topographies of behavior that occur out of context in young children with Down syndrome. We demonstrated that contextually inappropriate social behavior is sensitive to caregiver-reported contingencies (e.g., escape, attention, tangible). All nine children with Down syndrome, ranging in age from 2 to 6 years old, engaged in contextually inappropriate social behavior when they were asked to engage in a task. Consistent with Fidler (2005) and Wishart (1993), those tended to be difficult or non-preferred activities related to areas of relative weakness such as fine motor tasks. Differentiation between test and control sessions was demonstrated across all nine participants, suggest a pattern of contextually inappropriate social behavior and sensitivity to similar contingencies of reinforcement. Weaker demonstrations of functional control for Rebekah and Spencer may have been related to the choice of activity as the context for the control condition. Brandon may have been less socially motivated overall, engaging in increasing rates of other problem behavior (not orienting to the caregiver) even in the control condition. Trends across test sessions displayed an overall increase in contextually inappropriate social behavior and even other problem behavior compared to control sessions. Our results provide strong evidence to suggest that when difficult tasks are presented to a child

with Down syndrome, rather than or in addition to overt problem behavior, they may engage in contextually inappropriate social behavior, which may be harder to detect, more likely to be reinforced, and therefore persistent. If the difficult tasks are critical for development, it follows that this pattern may be disruptive to learning.

Like contextually inappropriate social behavior, we saw overall higher proportions of problem behavior in test versus control conditions and increasing trends in problem behavior across test sessions for some children. Similar response patterns between contextually inappropriate social and other problem behavior suggest that they may have a history of contacting reinforcement in similar situations and may have the same function. Increasing trends across test sessions also suggests that, not only did children employ social (and other) behaviors during difficult learning opportunities, but they may have been more motivated to do so each time we introduced the activity. These findings are consistent with Pitcairn and Wishart's (1994) description of poor task persistence. Individuals with Down syndrome often refuse to engage sufficiently with activities to master important skills, even after taking a break. One of the results of this poor persistence is failure to maintain or build on previously learned skills (Wishart, 1993).

For some learners, the contextually inappropriate social behavior may be a precursor that predicts when overt problem behavior is likely to occur and has the same functions (Borrero & Borrero, 2008; Warner et al., 2020). Caregivers who sometimes report that the topographies tend to co-occur, may be more likely to reinforce contextually inappropriate social behavior to avoid overt problem behavior. For example, Rebekah's mother described how she smiled and said "I love you" or that she was "too tired" when difficult tasks were presented. If her mother persisted in trying to engage her with the activity, she further reported that Rebekah was likely to have a "meltdown." Hodapp (1999), Hodapp et al., (2003) and Sellinger and Hodapp (2005) described how the behavioral patterns of individuals with Down syndrome have indirect effects on caregivers' perceptions and behavior. Caregivers may perceive contextually inappropriate social behavior as a more appropriate way to refuse a task than overt problem behavior and as a clever demonstration of savvy social skills. In situations where the contextually inappropriate social behavior is not reinforced (e.g., school), the child may engage in the more overt and potentially serious topographies of behavior.

A careful examination of how we define and classify the topographies of problem behavior may be needed for this population for whom topography seems to influence what caregivers and others notice and reinforce. Our definitions combined two different factors: the positive social nature of the behavior (eye contact and orientation to the caregiver) and whether the

behavior might be recognized by others as overt problem behavior. When behaviors fell into one part of the definition or the other, they may have had different functions. For example, Rebekah, who was 5 years old, engaged in other problem behaviors that were more overt (i.e., climbing the furniture), even though they seemed to have the social aspect (looking at her mother) which may suggest the same function as her contextually inappropriate social behavior. The way we defined the topographies may account for some of the differences in trends that we noted. When problem behaviors masquerade as positive social behavior, identifying those that interfere with learning may be particularly challenging, especially for caregivers.

Although Wishart's (1993) research suggests that infants as young as 6 months of age already engage in this pattern of behavior, we were unsure whether caregivers would report a contextually inappropriate social behavior that interfered with learning. We recruited by asking for children with Down syndrome who "love to be social," which may have attracted a subset of families whose children engage in more social behavior than others. We did not, however, pre-screen social skills or verify this characteristic. In fact, the first nine families who expressed interest participated. While all the caregivers in our study did report contextually inappropriate social behaviors and described them as occurring during difficult activities, social validity survey responses suggested that caregivers may not have recognized that the contextually inappropriate social behaviors interfered with learning. Studies of functional analyses suggest caregivers have an important role in the assessment process (Hanley et al., 2014; Santiago et al., 2016). In our study, caregivers provided critical information that highlighted how pervasive and at the same time, elusive this pattern of behavior may be in young children with Down syndrome. After participating in the analysis, caregivers reported that they would interact differently with their child during difficult activities, suggesting that the process demonstrated how social behavior may also interfere with learning.

Caregiver-conducted analyses introduced some differences, however, between participants that may have influenced our results. While the presentation of an antecedent activity with vocal instructions and other response prompts (vocal, gesture, modeling, physical) in the test sessions was consistent within participants, it may have differed across participants. We also did not limit the delivery of praise during test sessions as caregivers were presumed to naturally provide praise while they engaged with their children. The pattern seemed to suggest that a more robust combination of synthesized consequences unique to each child and caregiver was likely maintaining the inappropriate social behavior in the context of a difficult activity. Future research might examine how the delivery of prompts and attention in the

context of difficult activities influences the extent to which children with Down syndrome engage in contextually inappropriate social behavior.

Caregivers who can detect whether the context calls for the observed topography of social behavior will be able to more confidently reinforce or at least not interrupt contextual social behaviors (e.g., smiling or laughing at a peer's joke, initiating a favorite social game during family time). It is important that caregivers and others, who understand that social behavior may sometimes be inappropriate depending on the context, are able to differentiate when to reinforce and when not to. For example, when Rebekah smiles and says, "I love you" after getting a hug, her mother might reinforce this by making eye contact, smiling, and returning the sentiment. If she says "I love you" out of context when asked to write her name (a difficult fine motor task), her mother might respond differently to ensure that the skill is completed and to make it less likely that the contextually inappropriate social behavior contacts reinforcement. Caregivers can prevent or minimize the negative effects of contextually inappropriate social behavior without denying or diminishing the social strengths which are the hallmark positive characteristics of Down syndrome. Caregivers can simultaneously hold positive perceptions of their young child's social skills (Hodapp, 1999; Hodapp et al., 2003; Sellinger & Hodapp, 2005) and avoid perpetuating the pattern of contextually inappropriate social behavior. If the pattern of behavior can be observed in children as young as 2 years old as our study suggests or even younger as Wishart (1993) suggests, caregivers who are aware of the pattern might be better prepared to help their children establish a positive learning style rather than one that contributes to a developmental gap.

The purpose of our study was to demonstrate the utility of the functional analysis for identifying sensitivity of topographically social behaviors to caregiver-informed contingencies of reinforcement typically associated with overt problem behavior in young children with Down syndrome. Given our results, interventions to prevent or treat the elusive interfering behavior might involve systematically manipulating the components of the activity such as difficulty level, delivery of verbal instructions, prompts, and reinforcers. When caregivers arrange activities differently and reserve the most valuable forms of social interaction as reinforcers, they might not only decrease the likelihood of contextually inappropriate social behavior but may also build tolerance for and increase engagement in activities related to important skills. Caregivers may also implement functional communication training (Carr & Durand, 1985), a common treatment following analyses of problem behavior to teach the child a more explicit way to refuse a task (e.g., saying, "No," "It's too hard") and ask for preferred forms of attention (e.g., saying, "Play with me first"). Giving and withholding consent/assent is also critical to self-advocacy, independent

living, and safety as children with disabilities who struggle with communication and social skills are at higher risk for abuse than children with stronger repertoires (Kim, 2010). When children with Down syndrome explicitly give and withhold consent, rather than engage in contextually inappropriate social behavior, which is difficult to interpret, caregivers and other instructors may have a better understanding of their preferences and perception of task difficulty and can then design more supportive environments that foster learning across the lifespan. For example, when a child smiles, but does not engage in an activity, an instructor may interpret that in several different ways or may need further assessment to understand the behavior. When a child, says, "no, it's hard," the instructor having a clearer understanding may immediately arrange the environment to reduce the difficulty level and/or provide supportive prompting and more potent reinforcement.

Our study adds to the exponentially growing body of research demonstrating the contributions of individualized functional analyses to the assessment and treatment of problem behavior. To our knowledge, our study is the first to provide evidence of contextually inappropriate social behavior in Down syndrome, a problematic pattern with unexpected topographies. Our extension of functional analyses to the examination of this pattern, demonstrates how social behavior in Down syndrome can contribute to poor task persistence and insufficient learning opportunities to master skills, because in the context of difficult activities, it is often maintained by contingencies delivered by caregivers. This highlights the potential benefit of initiating a functional analysis when a child with Down syndrome has difficulty learning any skill, investigating whether the child is engaging in contextually inappropriate social behaviors and if so, how they may be contributing to poor engagement and skill acquisition. This is part of the broader notion of considering information about characteristics of a disorder in the assessment of learning and behavioral difficulties and treatment decisions.

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Supplemental Material

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