

# Using Voice Assistant Skills in Family Life

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**Abstract:** Voice assistants are increasingly prevalent in family life, being used, for example, for listening to music, finding out information, asking jokes and playing games together. However, little research shows how such technology influences dynamic family interactions in the home over time. An in-the-wild study was conducted in six family homes over three weeks. An Alexa, with a number of skills, was set up in each home for the families to use. The findings showed differences in use over time. To begin, family cohesion behavior and family rituals were most prevalent. At the end of the study, the skills were found to motivate distinct family interaction patterns: including more collaboration to manage Alexa and scaffolding of children's interactions with Alexa, given developmental differences in users' grasp of Alexa's capabilities and limitations. We discuss how voice assistants support different interaction patterns and potentially, offer different learning opportunities.

## Introduction

A new technology in many family homes is a voice assistant, such as Amazon's Alexa or Google Home. These devices are often placed in the kitchen or living room, enabling all to interact with it; providing an additional source of entertainment for the family, for example, telling jokes, playing music, keeping track of time and playing games. Recently, Amazon's Alexa has expanded its repertoire by enabling users to download a diversity of 'skills'. These are voice-driven capabilities that are intended to provide a more personalized experience. For example, "Open the Magic Door" is an adventure skill that allows users to choose their path in a story by selecting different options through the narrative. Another one, "Kids court", allows families to settle arguments in an Alexa-run court while learning about the law.

Many of the skills are designed to support multiple users taking part at the same time, offering the potential for families to play together. This kind of social interaction is further encouraged by the affordance of the physical device – that differs from other virtual voice assistants, found on phones and laptops, insofar as their physical presence affords joint ownership and use – similar to other domestic devices, such as the radio, TV and toaster. Little is known, however, about how this combination of device and interactive user experiences are used by families in their own homes.

Playing games and music together can contribute to family bonding and building social and emotional connections (Boer *et al.*, 2014). However, the pervasive uptake of technology in the home is often seen as disrupting such shared engagement, arguably resulting in less face-to-face conversation (Turkle, 2015). But might the introduction of virtual assistants, as shared devices, provide both new opportunities and challenges for the ways families interact in the home? In particular, could the new types of skills, that run on the voice assistants, support these kinds of family interactions, by enabling new repertoires and learning to emerge? If so, how do they manifest themselves? Conversely, could interacting with them lead some family members to dominate while others get frustrated? Could they even promote sibling rivalry and family arguments?

We began to address these questions by conducting an in-the-wild study observing how the voice assistant, Alexa, was used and accommodated in family homes over a period of three weeks. Three different types of skills were downloaded onto it, for the categories of music, storytelling and games. These skills differ in the role that Alexa plays. In providing music, Alexa acts purely to provide content for the user to enjoy either for themselves or as a shared experience. The user usually drives what is played, either independently or in consultation with other people present. In storytelling, Alexa has a greater role in providing potentially immersive content. An audio story is presented with options that lead to different outcomes, hence providing more interaction between Alexa and the users. Games, such as Kids Hub, support a diversity of interaction styles, that have more potential for multiple users interacting with Alexa, as well as parent-child pairs.

The aim of our study was to explore how families learn the new skills and appropriate them into their life. Video observations and interviews were conducted to collect data for how and how often families used the skills. The findings from the study were analysed in terms of different kinds of family interactions exhibited across families. A number of different types of interactions were identified that facilitated family cohesion, bonding and empathy. Some entailed helping children to learn how to play, ask questions and take turns. Others encouraged rituals, routines and rivalry often exhibited in family life. We discuss how families adapt and exploit

the constraints imposed by voice assistants, like Alexa, to play, talk and learn and conversely, how different Alexa skills shape family interactions.

## Background

The home provides an informal learning environment where it is commonplace for parents to buy technological devices, video games and electronic toys for their children to learn with. Family practices, such as how technology is used for play in the home, have an influence in developing children's competencies with technology (Plowman *et al.*, 2010). Children's experiences with technology are influenced by specific family contexts and family culture (Weisner, 2002). But how effective is home technology in supporting learning? Plowman *et al.* (2012) conducted a two-year long observation of families, with pre-school children, on use of technology in the home. They identified four main areas of learning which can be supported by technology: (i) acquiring operational skills such as learning how to click buttons and learning about cause and effect situations, (ii) expanding general knowledge such as early literacy and numeracy, (iii) increasing self-efficacy for curiosity-driven learning and (iv) learning about technology in everyday life.

Based on an ethnographic study of family routines, Davidoff *et al.*, (2005) forewarned how smart home devices may negatively impact the balance of control in the management of family life, such as leisure planning. However, studies of the introduction of novel technology into family homes has been found to impact family behavior in a variety of ways. For example, Ganesh *et al.* (2014) found that the deployment of augmented reality technology in a family home setting was able to positively distract pre-school age fussy eaters from their dislike of green vegetables but also negatively distracted their siblings. The technology worked by removing the fussy eater's focal attention from the peas on their plate and instead switching their attention to observing and playing with animated lights projected onto it. Instead of simply refusing to eat the peas – as they normally did – the augmentation encouraged the young children to view the plate of food in a new way, and in doing so, shift their focus from eating as a primary activity. However, when parents and siblings also took part in encouraging the fussy child to eat their peas, the new technology sometimes triggered a negative response, causing sibling jealousy and competition. Hence, the context had a positive effect on the fussy eater but also impacted on the social dynamics of the family.

It has also been found that technology designed for the home can engage all family members. Plowman *et al.* (2010), for example, observed how parents and older siblings contribute to young children's engagement with home technology through guiding and scaffolding their interaction through spoken language, gestures and expressions. Conversely, school-age children can take more leading roles: a study of parent-child shared reading on tablets versus paper books reported that school-age children sometimes dominated when reading from screens compared to paper (Yuill & Martin, 2016). Furthermore, device type affected the nature of family interaction: using a screen altered the pair's physical positioning and the interaction quality was less warm than for paper books. Parents may also introduce a narrative through the technology that may be of particular motivational interest to their child. For example, Bhömer *et al.* (2010) designed a photo sharing device intended as a table centerpiece where personal photos downloaded from Facebook could be shared with the family at mealtimes. They found how different family members used the device as an opportunistic display of affection to each other, saying how much they loved particular photographs that popped up. They also found it was used to highlight and reinforce family ties, through the types of conversation that were triggered.

Short *et al.* (2017) found greater intergenerational equity of participation with a robot assistant for activities with distinct participant roles. Reeves and Nass (2006) have conducted much research investigating how people approach and treat computers. They will often confide in them more and anthropomorphize them, treating them as if they had human-like qualities. Other research has shown how people respond to technologies as though they were human even if they know they are not (Fong *et al.*, 2003). Additionally, people have been shown to attribute personalities to technology and to apply similar politeness norms from human conversation to such interactions (Nass *et al.*, 1999).

Virtual Assistants add a new dimension to how home technology can play out in family life. Not only can they take over the control of certain everyday activities, such as reminding users about events, they can also act as ambient conversational 'partners'. The nature and equity of family interactions is also likely to be influenced by the structure of different activities provided by virtual assistants. Young children have judged various virtual assistants to be friendly and trustworthy, and to vary in intelligence (Douceff, 2017). Druga *et al.*, (2017) found that younger children (3-4 years old) experienced difficulty interacting with conversational and chat agents, resulting in them becoming restless. Sometimes, they would try to reword their questions or speak slower. While people so far have used virtual assistants primarily to seek information, they have also been shown to contribute to humor in social situations and interruptions in human conversation (Porcheron *et al.*, 2018). Multi-member households and particularly those with children are more likely to personify voice

assistant devices. However, a study investigating virtual assistants in multi-party conversation demonstrated a number of problematic features which affect the flow of normal social interaction (Purinton *et al.*, 2017). This included the need to repeat and refine queries which were not understood by the virtual assistants, and enforced silence by conversation participants so that the virtual assistants could better understand their queries. However, these devices also enabled collaboration, in that any member could interact with the device at any given moment. Family members also tended to reason and reflect about the queries that were made. Porcheron *et al.* (2018) also examined how voice assistants were used by families in their own homes. They conducted a conversational analysis of some audio recordings that revealed subtle cues and mechanisms used during conversations. They report how a family's interaction with the Amazon Echo is seamlessly interwoven with other ongoing activities, for example, at family mealtimes where parents are at the same time trying to get their child to eat their food. They point out how our conversations with each other and voice-assisted technologies interleave in nuanced ways, rather than being separate conversations between the family or the family and the device, that jump from one to another.

A recent panel discussion on voice assistants (Kaye *et al.*, 2018) identified as important research foci the ways that families interact with voice assistants, and how users understand their capabilities and limitations. Some answers are provided by Sciuto *et al.* (2018) who analyzed Alexa voice logs for 75 users over a period of about a year, and also interviewed a number of Alexa-owning families with young children under 4. However, to understand the roles that Alexa plays in family interaction, we also need to observe audiovisual dynamic interactions in families with varying compositions, and children across a wider age range, preferably over a period of time and in relation to a range of different voice assistant skills that might engage users differently. The aim of our research was to explore how families approach and interact with different skills downloaded onto Alexa in their own home. Our focus was on how parents and children engage with different skills when they are together, across a range of ages and family types, including only children and those with siblings.

## Method

An in-the-wild study was conducted in six family's homes. The families were given an Alexa to use at home over a period of 3 weeks. They were visited at the beginning and end of the study period when all or most of the family could be present. Ethical approval was obtained from the University Ethics Committee and informed written consent for self and children was gained from parents, as well as assent from the children. They were told that their conversations with Alexa would be recorded for subsequent analysis. All families were given the opportunity to review the Alexa recordings before analysis in case they wanted to remove any items: none chose to remove items.

## Participants

Participants were recruited through flyers, social media, word of mouth and snowballing in south-east UK. The details of the families who participated in the study are shown in Table 1. All had children in the age group of 2-13 years. A broad age range of children was selected to increase the potential for a wider set of interactions to be revealed. Five of the families had used a voice assistant at home and the other was familiar with them.

## Skills

Three skills were pre-loaded onto the voice assistants. These were (i) Music, (ii) Pac-Man stories and (iii) Kids Hub. The families with previous experience were familiar with playing music but did not have experience with the other two skills. The skills were all highly-rated on Amazon and appropriate for the wide age range of participating children. They were chosen for the types of interaction they offered and the degree to which multiple family members would likely participate in using them. (i) Music is essentially providing content, as easily for an individual as for a group. Individual use is supported because music interest likely varies across our wide age range. However, music could also potentially encourage playful interaction in the form of dancing and singing, given the shared audio experience for anyone in the room at the time. (ii) Pac-Man stories is a spoken interactive adventure style game. It similarly provides content accessible for an individual, but has more potential for interaction, because Alexa invites the player to choose alternate paths. The game incorporates sound effects and music, thus supporting the user to become immersed in the story. As with music, this may also have the potential to encourage participation in the form of dancing or engagement from family members not primarily using the skill. (iii) Kids Hub supports a diverse range of more interactive participation, allowing users to choose from a variety of activities including songs with actions, Tongue Twisters, Pictionary and Kiddy Olympics. These activities can be readily used by more than one person and are appropriate for families with single and multiple children.

Table 1: Details of families who participated in the study

	Children	Age	Parents	Previous voice assistant
<b>Family 1</b>	Boy	6	Mum, dad	Yes – Google Home
<b>Family 2</b>	Boy	11	Mum, dad	Yes – Amazon Alexa
<b>Family 3</b>	Boy	13	Mum	Yes – Amazon Alexa
<b>Family 4</b>	Boy, girl, girl	6, 9, 11	Mum, dad	Yes – Google Home
<b>Family 5</b>	Boy, boy	7, 10	Mum, mum	No
<b>Family 6</b>	Girl	2	Mum	Yes – Amazon Alexa

## Procedure

The researcher visited each family home for about an hour and set up the Amazon device in a place chosen by the family – the living room or the kitchen. She explained how to use the three skills. The families were free to explore them. A camera was set up in the corner of the room to record the interactions during her visit. Afterwards, the family members were asked about their reflections of Alexa and how they imagined it would be used in the home. The families were asked to explore the skills for a week. They were then sent a link to the online Alexa Skills catalogue and given the option of downloading additional skills, for the following two weeks. The researcher visited the families again at the end of the study to ask them to reflect on their use of the Alexa skills.

## Data collection and analysis

Video recordings were taken during the first and second visits and conversations and interactions with Alexa transcribed. In addition, the voice recordings from when anyone interacted with Alexa were collected and transcribed. Both were coded separately for each visit by one rater using NVivo software, and all codings were reviewed by a second rater and placed into themes. These themes were extracted and validated as modelled by Saldana (2016), by discussing them with colleagues and checking interpretations with the participants themselves during the second visit.

## Findings

All the families tried out the three skills and several families downloaded other skills. There was much enthusiasm about how they had interacted with Alexa and how it became part of their family rituals. Usage of the skills persisted across the three weeks - as evidenced by the conversations recorded by Alexa. Some families reported using the device during meal times while others used it during shared activities such as cooking or after-school play. The younger children (aged 6) in the families were curious about Alexa, asking it a range of questions, as if it was a friend, for example, “*Alexa, what am I doing right now?*”, “*Hey Alexa, what's your second name and your third name?*”, “*Alexa, who is your favorite YouTuber?*”, “*Alexa, is Google and Siri your friends?*” One family (family 1) even resorted to asking Alexa during a meal time to resolve a debate: “*Once we used it when we were all eating, like we were having our meal and asking it questions... That's what it was, we were discussing something, and we didn't know who was right, so we asked Alexa...*”

To examine further the different ways Alexa became integrated into family life we identified and then categorized excerpts from the transcripts in terms of three main themes: family cohesion, family rituals and scaffolding. These were further classified in terms of the specific mechanisms used when interacting with Alexa. Certain themes recurred both within a single observation (i.e. behaviors were observed repetitively in the same family or a theme was mentioned a number of times within the same family) in addition to being a common theme across families. The quantity of incidences together with specific examples and comments made by the families are provided below. The most frequent interactions observed were in the scaffolding category, where different family members helped each other but especially younger children interact with Alexa.

### Family cohesion

Many forms of family cohesion was observed across all families. These were classified in terms of shared laughter, teasing, exchanging gestures and facial expressions and family rivalry.

*Shared laughter.* The interactions with Alexa often resulted in much shared laughter. 62 instances were identified during the three weeks for all families. They typically happened when family members were playing a game and when a mishap occurred, that Alexa was not privy to. For example, when playing the Kids Hub skill, family 3 chose the activity "Pictionary", a charades-style guessing game. In this game, Player 1 has ten seconds

to leave the room and following this Player 2 is given a word which they have to draw. Player 1 then comes back in the room, looks at what the other person has drawn and tries to guess the word. In one game, the son overheard Alexa give his mother the word "dog" to draw. They continued playing the game and the mother mentioned the word by mistake to which the son retorts:

Mother: *"This doesn't even look like a dog"*

Son: *"You just told me!"*

At which point they both laugh and the mother continues, *"Well you heard it anyway. I'm not good <at drawing> this looks like a cat, maybe even a pig"*

Shared laughter was also observed in situations where Alexa didn't work as intended, for example when it was unintentionally activated by a TV ad (family 4). Alexa's misunderstandings of what someone said were also a source of amusement. One child recalled a situation where Alexa misunderstood his mother's request: *"Oh, when you were asking how long to cook sausages for. And then it tried to order sausages!"* (family 3).

*Teasing.* There were also several instances of teasing (34) recorded, although considerably less than the shared laughter, across five of the families. Typically, family members interacted with Alexa to make fun of or provoke other family members in a playful way. For example, the child in family 2 was playing a music quiz online and losing to an opponent (Tom) in Texas. He kept looking at his dad to see if he knew the answers:

<Alexa plays next song>

<Child laughs and grimaces to his dad to indicate that he doesn't know the song>

Child: *"Skip"*

Alexa: *"The song is Timber by Pitbull, Tom answered correctly"*

Father: *"Tom needs to get out more."*

<Next song comes on and child looks at his dad and laughs>

Father: *"don't ask me!"*

The parents in family 1 often asked Alexa to play the good morning and the good evening song. When asked about this, the mother laughed and said that she would put the song on to annoy her son in the morning while he was getting ready for school or when it was time to get ready for bed.

*Exchanging gestures and facial expressions.* Families often reacted to interactions with Alexa by exchanging facial expressions, mimicking Alexa or making faces in response to things that it said. There were 41 instances of this coded for families 1,3,4 and 6. An example of exchanging facial expressions was when the mother and son (family 1) were listening to "fun facts":

Alexa: *"In the 18th Century it was believed that kissing a donkey could relieve toothache."*

<Son and mother make a disgusted face at each other >

An example of mimicking Alexa was when one family switched Alexa from having a British accent to an Australian one. The father then started speaking in an Australian accent which the children found funny. They then also tried to talk in an Australian accent. This led to much banter.

*Family rivalry.* A normal aspect of family life is sibling rivalry - when children think they are getting unequal amounts of attention or responsiveness from their parents, or intergenerational conflict. 45 instances of this were coded for families 2, 3, 4 and 5. Family 2 said they sometimes struggled to take turns to choose music because they did not like each other's choices. In contrast to other personal technologies, where the person holding a device or remote control has sole control, everyone has equal access to control of Alexa. This can mean anyone can override or interrupt what the other has asked Alexa to do as one father commented: *"It was like one of us would put music on and then the other one would change it when they couldn't put up with it anymore, so we weren't taking turns."* One mother also explained how when her children try to use Alexa at the same time it could lead to arguments. For example, the siblings in Family 4 often competed for Alexa's attention with different requests and then became upset when the mother gave her support to the other one:

Mother: *"Alexa play barking"*  
Youngest child: *"I don't want that!"*  
Mother: *"Well you're gonna get it."*  
Youngest child: *But he got what he wanted!*

Another time a mother (family 5) tried to reason with her elder child about needing to be fair with his younger brother:

Mother: *"Did you take it in turns?"* <when asking Alexa for music>  
Elder child: *"Yeah, but then he got to choose."*  
Mother: *"Well probably because you'd been up for an hour already and had loads of choices before he came and had breakfast."*

### Family rituals

Family rituals are an integral part of family life. These were much in evidence when interacting with Alexa, with 58 instances coded across all families. Most were triggered during the playing of a song. For example, when a child requested Alexa play the 'Baby Shark' song every day, the mother groaned each time, but then the whole family would start dancing and singing along. Another example, is where the mother of family 1 requested a song on her son's behalf to which the father looked at the son and encouraged him to show off his dance moves:

Mother: *"Alexa play the gummy bear song."*  
<Son looks at his mum>  
Father: *"Show her your dance moves"*

Another child (family 4) commented how their parents now refer them to ask Alexa if they want to find something out rather than looking it up themselves on the internet: *"If mum or dad are doing something and I ask them a question instead of going like have you searched it up they would say go and ask Alexa."* This shift requires them formulating and talking aloud their query which the parents can be privy to if in the same room and join in or be aware of what their children are trying to find out.

### Scaffolding

A common occurrence was when family members collaborated by encouraging each other when using Alexa. 111 instances of these were observed across all families – making this the most frequently observed category. This happened either when the family worked together as a team or when a more competent family member helped a younger member interact with Alexa.

When playing a story skill with Alexa, such as PacMan, family members sometimes whispered to each other what they should do before asking Alexa – so as not to let it hear or know about their discussion before making their choice. Thumbs up gestures and nodding were also employed during this kind of behind the scenes negotiation process. Sometimes one person would take the role of leader while the rest of the family members would whisper to each other what to answer. For example, family 4 discussed which option to choose before the youngest child eventually shouted out their answer:

Alexa: *"You could pick up the fork or you could read the sign."*  
<All whisper to each other to decide which one.>  
Mother: *"What do you want to do?"*  
Youngest child shouts: *"Pick up the fork!"*

When Alexa did not recognize what a younger member of the family said, other family members often repeated it slowly to encourage the child to try again but to speak more clearly. For example, the youngest child in family 4 wanted to play a funny song but was not able to say the word of the song correctly. His older brother helped him by repeating it and gesturing at Alexa to indicate where to speak. One mother (Family 5) commented on how it was much harder for the younger child to be understood by Alexa. When they struggled with some of the questions she would try to rephrase it to be simpler, so the child could learn how to be more concise. Similarly,

in family 2, the father pointed out how Alexa does not understand his 11-year-old son as well as himself. Another mother (Family 1) often encouraged her child to interact with Alexa by pointing at it:

Mother to child: *Do you want to hear another?*

<Mother points at the Alexa to encourage child to ask>

Child to mother: “yes”

Another strategy families used to encourage their children to speak to Alexa was to tell them how to ask Alexa questions. Families also encouraged their children to practice speaking to it. Hence, there were many examples of parents helping their children to learn how to speak with Alexa to make themselves understood.

## Discussion

The findings demonstrated how families engaged in a diversity of interactions when using the Alexa skills. They developed new family rituals and encouraged each other to talk to and take part in games with Alexa. Many of these interactions could be seen as contributing to social and emotional bonding, leading to further family cohesion. For example, the use of non-verbal behavior while interacting with Alexa provided a means of expressing empathy. They all took to having a new voice in the family home – like having a new family pet. However, the interactions that occurred were not always harmonious and sometimes led to family disputes. In a way, this reflects the richness of family life, where children learn to compete with their siblings but also learn to empathize with them; where families develop new rituals by playing games or performing together and in doing so bond over them but at other times use the opportunity to tease each other.

Lots of shared laughter occurred because of Alexa’s mishaps especially when it misunderstood them. For younger children, this could be quite frustrating and at times challenging. Parents and elder children were acutely aware of what they were going through and would often try to help them out, by showing them how to interact with Alexa. Other times, activities with Alexa led to joking, joshing and teasing, building upon pre-existent family discourses about particular interests or sensitivities. Alexa was also incorporated into existing family dynamics and could sometimes encourage or amplify those, for example, when commenting on different tastes in music or different realms of expertise across family members. Different interests across family members could also lead to disagreement, particularly when children wanted to play certain songs or games repeatedly. This happened both between siblings and between parents and children.

Alexa in its current form was unable to recognize different family members by their voice. This meant it could not understand different people talking simultaneously – which families often do in family conversations, and during which they are able to hone in on what one person is saying (cf. the cocktail party effect). To adapt to Alexa not being able to do this, families adapted their behavior. For example, they would all sit together, often on the same sofa, facing Alexa and communicate with it, as a family unit, rather than carry on having a conversation with each other. Alexa became the central focus for their interaction. This differs from Porcheron *et al.*’s (2018) finding where the conversation with Alexa was interwoven with the parents taking turns to talk to cajole their child to eat their dinner.

Families frequently used back-channel methods of communicating, such as whispers, to avoid getting unintended responses from Alexa. Sometimes this was done in the spirit of pretend play, where families whispered together so that the children would learn how to make joint decisions together when playing a game that others would not be able to hear – in this case Alexa. Once agreed on their answer, an elected person (self or other) in the family would call it out to Alexa. This pattern of interaction was observed when families played games together. However, problems sometimes occurred when there were younger children in the family who found it difficult to follow the rules of playing a game or a quiz, or when siblings felt unequally treated. When such times arose, families changed tack to deal with them, for example, the parents and elder children adopted helper roles to encourage and make suggestions for what the younger child should say to Alexa.

Alexa was also found to encourage families to jointly act out together, namely singing and dancing. Having an external participant made this appear like a performance, as evidenced by parents sometimes referring to Alexa as a potential audience, for example, suggesting that their children show Alexa their dance moves. Listening to music together is something families may already do, for example on journeys in the car. Teenagers may listen to music together and act out the singer’s dance routines. With Alexa, it became possible for families to feel comfortable with all the members dancing and singing repeatedly. Even the mother groaning appeared to enjoy being part of the ritual. And, as Druga *et al.*, (2017) point out, family rituals have a positive impact on family cohesion and emotional well-being. In terms of learning, children were inducted into a whole range of skills in how to tailor their communication to a new audience member, how to hold the floor, and how

to use back channels of communication when there are interactants with different needs. Having a new interactant in the house also gave new possibilities for performance, and engagement with music in particular. Further work will reveal how the role of voice assistants in the family may evolve over the longer term.

## Conclusion

Voice assistants, like Alexa, are making big in-roads into family homes. Our study showed how families readily appropriate them into their family life, playing, singing, performing and even asking Alexa questions to resolve family disputes. Alexa was found to encourage much shared laughter and helping each other but also trigger sibling rivalry, teasing and family arguments. However, both negative and positive aspects of family interactions are an integral part of learning about each other and developing empathy skills. Contrary to Turkle's (2015) concerns about the digital age, interactions with voice assistants such as Alexa, may even help children learn the art and joy of conversation in the presence of humans and machines.

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