



Seating systems for children with special needs

—
The best position is the next one!

IGAP

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children-rehab

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An information brochure

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Dear Reader,

we would like to address this information brochure especially to those who wish to gain insight into the process of selecting assistive technology or seating systems for children with special needs. Informing parents is particularly important to us. Choosing the right seating device often is a complex decision for both parents and medical professionals. There are many different facets to consider.

Often, several parties must agree on this issue. Parents may have a differing opinion or idea from that of the doctor or therapist. The product specifications must be determined with the medical equipment dealer, and all of this must be carried out to everybody's satisfaction.

Finally, in most cases the costs have to be covered by health insurance.

This handbook will help everybody involved in the selection and acquisition of seating systems to better understand this complex process. Certainly, the basic information also applies when selecting and acquiring other assistive technology (e.g. walking or standing aids).

As the sub title of this brochure, "The best position is the next one" indicates, those of us at the IGAP Institute would also like to see that the idea of dynamic but at the same time stable seating for children be considered when selecting assistive technology in general and particularly seating systems.

We would like to sharpen your senses to assess when cases require rigid and purely passive seating, and why it is worth considering other possibilities, as well.

Enjoy reading this brochure. We hope you find this information helpful for your continued work with children that have special needs.

Team Children-Rehab of the IGAP Institute

How and when does a child start sitting “normally”? What needs to be done, when this does not happen?

As a rule, children are able to sit independently between the 9th and the 11th month of life.

This step is crucial for further development possibilities. Only at this point can a child use their hands to touch, explore, and hold things, while maintaining visual control at the same time.

The ability to sit up is an important step in a child’s social development. The child comes into contact with other people at eye level, and thus is no longer viewed passively from above.

Sitting independently announces the end of the “baby era”. Along with other developmental milestones, the child becomes an autonomous person.

A special seating system becomes important, when ...

1. ... sitting independently happens very late or not at all.

For cognitive and fine-motor development children must be able to use their hands independently. At the same time, they need to see their own fine-motor movements.

A special seating system becomes necessary when children are unable to sit upright independently, prohibiting development in other areas.

This is important not only to play and explore their environment, but also for eating and drinking. It may be very difficult and hard on their back for a parent to hold a large child on their lap for feeding.

This passive, half-lying position is also not beneficial for the independence of the children. Moreover, children with disabilities often have problems eating and drinking.

Contrary to common opinion, swallowing problems cannot be improved while eating in a half-lying position.

In this way, liquids simply “run into the child’s body” and the risk of choking or aspiration (inhaling the liquid) increases.

If it becomes clear that a child is unable to sit independently, a special seat will become necessary in the foreseeable future.

However, this decision should always be made consulting a doctor and / or therapist, who know the child quite well. (Fig. 1)

2. ... the sitting posture is very unstable due to motor difficulties.

Toddlers who are not yet able to **stand** or **walk** by themselves still have a backward-tilted pelvis when sitting. The center of mass of the pelvis then lies behind the ischial tuberosities.

In this posture, straightening up the spinal column is nearly impossible. The back is curved and the head falls forward or is super extended for **compensation**.

In both cases, eye-hand-coordination is strongly restricted. In addition, the child cannot use their upper limbs for fine motor activities, since they are needed to stabilize and support the posture.

In normal development the pelvis adapts itself eventually. The muscles involved get stronger and allow the child to sit upright. For children with functional

motor limitations, this process is often insufficient. (Fig. 2)

Weak trunk muscles, spastic movement patterns, or uncontrolled, exaggerated trunk motions may also restrict a child's ability to sit independently.

These restrictions should be balanced in the best possible way by supplying a good seating system.

A good seat helps straighten the pelvis and / or provides stability in the trunk. (Fig. 3)



(Fig. 1)



(Fig. 2)



(Fig. 3)

The seating system should suit both the child and support their daily activities

In taking a closer look at special seating systems, one very important issue is that the child should sit “nicely” upright and straight. It certainly is important to position the child as symmetrically and upright as possible to prevent possible complications (slanted postures, hip problems, and contractures).

However, forcing a child into an upright and straight posture is not appropriate when it is at the expense of everyday practicality. Nor should it limit the child’s ability to be active.

Besides providing good postural support for the child, it is crucial, that the chair suits their everyday life and meets all the technical requirements (such as seat height, width of the base frame, etc.).

When evaluating or prescribing a chair, one should carefully consider the intended situations when the chair will be used.

- Shall it support activities like eating or playing?
- Or, is it a chair for passive moments, to allow the child to relax?
- Or, should the chair be adaptable to all these situations?

Should harnesses, for example, be used temporarily?

Many children need an upper body support only when they are tired, become floppy and begin to migrate out of position. In very awake phases, the same child may manage quite well to keep themselves upright. These situations must be seriously considered when assessing the individual child’s needs.



Important:

*Make sure that the equipment and accessories that you choose support your child appropriately even when their condition is weak. Always pay attention to what your child needs in any particular situation. **Sometimes less is more.***

What does muscle activity mean, and what does it have to do with sitting?

Muscle activity is the contracted state of the muscles. Here one can decide between the resting tone and the muscle tone during activity.

To be able to adapt the muscle tone to the respective situation or action, we need significant experience which allows us to adjust ourselves to new situations over and over again.



Significantly reduced tone in the upper body

This, among others, is the reason that small children need so many movement, sensory, as well as other general body experiences for their development.

When sitting, the tone keeps our trunk muscles upright. That means we are constantly working with and against gravity.

This is a problem for many children. Children with neurological problems show the following problems of muscle activity:

- a) Limp or weak muscles
- b) Spastic hypertension
- c) Unintentionally fluctuating tone

a)

Central brain damage (e.g. cerebral palsy) causes the trunk muscles (mainly the tonic muscles), which normally take over the static work, to become hypotonic, or low in basic tension. These muscles are mainly needed to maintain posture, i.e. to straighten up the trunk and to keep it upright against gravity. (s. image)

b)

On the other hand, the phasial and more dynamic muscles of arms and legs often show overly high tone or even spastic movement patterns in these clinical pictures. However, depending on the clinical picture, hyper tone can occur simultaneously in other muscle groups.

c)

In clinical pictures with an athetoid component or generally in the case of dystonia, the muscle activity fluctuates unintentionally. The children barely have control over their own motor functions and show strong tension and activity in both their trunk and facial muscles. This clinical picture is characterized by exaggerated, uncontrolled movements.

Sitting and fine motor skills

Like a tree, our trunk is the “bole” that provides stability. The branches of a tree can be compared with our arms and hands. They can only develop when the bole is strong and gives support.

Children with weak, too strong or unintentional muscle activity have great difficulty in using their hands purposefully. In these cases, a good seating system can help them work more precisely with their hands. This means that the seat provides the basis for fine motor possibilities.

A simple strategy of many hypotonic children (low muscle activity) is between-heel sitting. This gives them stability and leaves their hands free to play. However, this has a negative effect on the hip joints and should not be thought of as a permanent solution.

Instability in the trunk always influences the motor functions of the hands and arms. A child whose upper body continually slumps down, because they are not able to build enough tension in their trunk, automatically tries to compensate for this by increasing the tension in arms and hands. This again severely restricts the possibility of being active with the hands.

These exact circumstances call for stabilizing seating devices.

But a seating device that does not leave any freedom of movement can restrict activities to the same degree as too little stability. Arms and shoulders must be able to move freely. When sitting, the children should be able to bend slightly forwards or

to the sides with their upper body, so that they can, for example, reach objects on the table.

Sometimes this is the biggest challenge in the selection of a seating system: To balance the need for stability with that of movement.



When between-heel sitting, the femoral head is rotated out of the hip socket due to the unfavorable position of the thighs.

It is important to find out about the individual needs of every single child.

How much support does the child really need?

When does the stability of a seating system restrict the child too much?

Which kinds of seating systems are available for children with special needs?

In the children's rehab world there are numerous product types and many different manufacturers and models. This abundant product variety often makes it difficult for parents, doctors, and therapists to decide.

To make matters worse, the same product types are named differently in the market.

In the following, we would like to differentiate between:

- a) **Therapy chairs**
- b) **Seat shells (custom or molded)**
- c) **Mobility seat with MiS Micro-Stimulation®**

a) Therapy chairs

Amongst seating devices, therapy chairs are the “simplest form”. Normally, they are available almost completely ready, right out of the box. Here, ready out of the box means that the parts are not individually produced for a specific child by the dealer, but that they are already available from the manufacturer including accessories. We will give only general information here, since there are so many different therapy chair designs available. Therapy chairs are mainly suitable for children who do not suffer from severe deformities of the skeletal system and who are able to build a certain degree of stability on their own. Sometimes the therapy chair is needed because the children cannot manage to sit independently over a longer period. In other cases, they are not able to find the center of their body and tend to lean to one side.

Functions:

Therapy chairs can be adjusted to the individual body dimensions of the child.

In this way, for example, the seat depth can be adjusted, making full contact with the thighs providing a larger, stable base of support. Other dimensions, such as back height, seat width, and lower leg length can also be adjusted. This has the advantage of the chair “growing” with the child for several years.

Almost always, therapy chairs offer a wide variety of positioning supports, such as lateral trunk supports, headrests, and footrests. There are also therapy chairs that are able to straighten and stabilize children without the need for hip belts, chest harnesses or pillows. This is due to the shape of the seat or the positioning method (s. images below).



Therapy chair with castors and height adjustment

Therapy chair for abducted, active sitting and for independent locomotion



The decision about which chair is suitable or what equipment is necessary should be made in consultation with qualified staff. Moreover, assistive technology in general and also therapy chairs should be tried before making a definitive equipment selection. A photograph in a catalogue will never be able to show how the child may react or how well the parents will be able to work with the product in everyday life.

b) Seat shells (custom or molded)

Custom seat shells are seating devices produced individually for a specific child. As a rule, an aluminium corpus is equipped with foam pieces, which are produced according to the body dimensions and needs of the child. In most cases, this is done by a specialized medical dealer.

These seat shells can then be used on a variety of base frames (indoor-, outdoor-, combi-frames, or wheelchairs) for different purposes.

Functions:

Due to the individual production and the shell-shaped design, seat shells normally offer more support than out of the box chairs. Frequently, they guide and hold the body very closely. In addition, they can be equipped with hip belts, harnesses, or pillows. Children with more severe disabilities may benefit from this. On the other hand, these seating systems do have some disadvantages. One point is that they don't grow with the child very easily. When the child grows, cushion parts need to be reworked, made new or altered to fit. This cannot be done easily and quickly, because the medical dealer has to do it.

Another point is that the children do not need much personal activation to sit upright

in these seating systems. On one hand, these systems provide a lot of stability, but on the other hand, they restrict movement and take away flexibility. Because of this, one should seriously consider how much support is really necessary. The question looms if this good stability might limit the possibility that the child may eventually be able to sit upright on his / her own. Only this will ensure that the child is not being given and "oversupply" of support.



Seat shell made to measure

Molded seat shells

The construction of a molded seat shell with an aluminium corpus and inner cushion is basically the same as that of the custom seat shells. The significant difference is that the cushion is made from a mold of the child.

This mold is made either with foam or with a vacuum pillow.

Functions:

Due to the direct mold, a very close impression of the trunk, pelvis, and legs is achieved. This means the child is kept in this absolutely passive position created by the mold. This system is mainly beneficial when skeletal deformities already exist and to prevent further degeneration, e.g. for a scoliosis not treated with a corset. For other clinical pictures, most notably severe athetosis, the close shell, surrounding the child, may have a calming effect and reduce exaggerated movements.



Molded seat shell

As with the custom seat shell, the difficulty or disadvantage of molded seat shells is their inability to grow with the child. A growth adaptation is even more complicated here. The shell often needs to be ground away when the child grows. But by doing so, this is not serving the true purpose of a molded seat shell.

The choice of the child's clothes becomes more complicated, too, when using a molded seat shell. If the seat shell is, for example, being used both indoors and outdoors it is no longer possible to wear conventional coats. It often becomes necessary to purchase special coats for seat shells, which can be closed in the back behind the shell.

Such a complex system should always be well-considered and compared with other possibilities. The molded seat's stability always involves immense immobility. The risk of developing pressure sores is considerably increased. Independent activity of the children is greatly reduced.

The important thing is

... to position the child well during molding. This is the seated position the child may have more or less permanently in the future. To achieve good positioning it often takes at least two persons. If the child is very restless, with strong spasms or if the child is athetoid, additional persons may be necessary to hold and provide assistance.

Considering the child's clothing is very important here. The shell shall sit very closely to the child with less than a 2 cm (0.8") space in-between the child and the seat. Therefore, the child should wear neither very thick nor very thin clothing during molding. Instead opt for normal daytime clothes of average thickness.

c) Mobility seat with MiS Micro-Stimulation®



Mobility seat with MiS Micro-Stimulation®

The active principle of the MiS Micro-Stimulation® systems is mainly based on the theoretical basics of different therapy concepts, such as basal stimulation, the Bobath concept, and kinaesthetics.

Elementary is the knowledge that humans need to move, regardless of their physical constitution.

MiS Micro-Stimulation® systems support and maintain the mobility and thus the perception of the children. This is done by so-called wing suspensions, integrated in a dynamic backrest. The freedom of movement, required e.g. in the upper body for unrestricted fine-motor activities, is possible with a dynamic system.

At the same time the MiS Micro-Stimulation® seat units provide stability, where it is required. This means that the backrest is equipped with this flexible system whereas the pelvic and the entire seating area are a solid base.

Functions:

An MiS Micro-Stimulation® seat unit or a therapy chair with MiS Micro-Stimulation® comes ready out of the box from the manufacturer. The seat adapts well to the changing requirements of the child (by growth or development). Based on the degree of support that the child requires, different postural supports and accessories are available.

On one hand, these seat units are suitable for children who are able to build more self-activity in their trunk by the flexible wing suspensions. On the other hand, children who are less active can benefit from the fact that they no longer have to sit fastened, without being able to move.



Child in a mobility seat

Important: Although the trunk is supported, movements of the trunk are still possible, since the child is always brought back into the original position.

Another advantage is the breathability of the back. Heavy sweating is avoided. See image above.



The following should be considered when choosing the right seating device:

- a) Any seating device should be tried before making a decision. The individually produced seat shells are an exemption of course, although they should also be tried with the child before completion.
- b) When choosing the degree of support that the child needs, the motto should be: "As much movement as possible and as little passive stability as possible."
- c) No seating device should allow a child to sit in it for hours, without moving. Freedom of movement and, above all, changing positions are absolutely essential for any child. Offering different positions (lying, standing, sitting) is indispensable in everyday life, especially for children with motor disabilities.
- d) When deciding on a certain chair or seat, the environment in which the device will be used should always be considered. A therapy chair can only work as well as its suitability for the child's individual needs. It is also important to define what the child will do in this chair.
- e) Static, rigid seating should be chosen only when it is clear that dynamic or independent seating is not possible.

Important: The team involved in the supply consists of the child, parents, caregiver / nurse, doctor / therapist, and medical equipment dealer. All parties involved should mutually agree and work together to achieve the same targets and goals.

Orthopedic problems in the supply of seating systems

Orthopedic problems must be considered when selecting a seating system, consulting the orthopedist or pediatrician in charge. They rarely appear separately and are often mutually dependent.

For an easier understanding, they should, however, be viewed separately. These are some possible problems or questions:

Fixed ankle joints (pes equinus):



Pes equinus often are a consequence of permanent hypertonia in the calf muscles, as is often the case with spastic movement disorders.

The functional pes equinus normally develops when the child starts to straighten up to stand or walk. Due to the increased activity in the legs the tone in the calves increases and the foot is pulled into the footdrop position. In addition, children who lie down all of the time can develop a pes equinus. In a contracture, the joint cannot be brought back into a neutral position because of a soft tissue change (tendon shortening) or a change in the bones.

In selecting a seating system the pes equinus is a problem because of the generally missing "root" for stability.

Our feet are the basis for stable sitting. We can notice this when we sit on a chair, then lift our legs and try to keep an upright posture.

Often it is said that children should move without shoes as often as possible, but this rule cannot always be applied for children with physical disabilities. Therapeutic seating systems are either equipped with an adjustable footrest or can be adjusted in height to make sure the children always reach the floor with their feet.



No support surface on the footrest due to the pes equinus

Children tending to pes equinus or with stretched spastic legs are often not able to bring their feet into a solid, plane stand. Solid shoes and orthoses, possibly in combination with foot straps, can help to improve stability. In such cases, it is therefore recommended to wear shoes when sitting in a chair, a shell, or a rehab stroller.

Adducted thighs:

In central movement disorders pathologically increased tone (spasticity) tends to occur in the adductors, i.e. the inner thigh muscles. This causes an interior rotation of the child's legs. The children press their legs together very tightly and partially cross them.



Adducted legs with an obvious interior rotation on the left

In some cases this is so bad that swaddling the child is almost impossible. Moreover, the continuous interior pull has a negative effect on the position of the hips. Dislocations in the hips may lead to hip luxations, since the head of the femur is permanently being pushed out of the socket.

For the sitting position, this means that the contact surface becomes smaller and it becomes more difficult to straighten and neutralize the pelvis. Normally, you will now try to provide a wider sitting base using an anatomic mold in the sitting area or, if the adduction is very strong, by using an abduction block between the knees.

Important:

Be careful with the abduction block!!!

Unfortunately, the abduction block is often used as a “brake”. That means it is positioned at the level of the thighs in order to prevent the buttocks from sliding forwards.

This will not work!

First this is very painful (especially for little boys) having a block right in front of the genitals and always pushing against it.

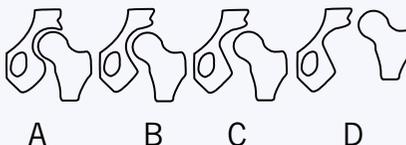
Second there is even more pressure applied to the adductors, which in turn promotes spasticity.

Conclusion:

If using an abduction block make sure to always position it at knee level!

A is a healthy hip;

D is a complete hip luxation



Furthermore, it is important to see whether the children are able to reduce tension in the adductors when sitting with abducted legs. If they cannot, the pressure is increased and the heads of the femurs are pushed out of the sockets even more. Another possibility to provide an open, active sitting posture is sitting on a roll or a therapy chair with a similar seat surface.

A posture similar to the one in horse riding provides for a wide and active sitting base which facilitates straightening the pelvis and spinal column. This, however, requires that the children have a certain degree of motor control.

A backwards (dorsal) tilted pelvis / kyphotic (round) back:

The posture shown below is a very typical one:



The legs are stretched out, the pelvis tilts considerably backwards. This again leads to a strongly curved spinal column. The reasons for this often are weak trunk muscles. The waist and back muscles are not able to stabilize the pelvis or adequately support the spinal column.

Moreover, the muscles of the rear thighs and the hip flexors intensify the pull of ligaments and soft tissue. Healthy people also tend to adopt such a passive posture in

sitting. If we watch ourselves, most people will recognize that they slip forward in the chair and bend forward with the back.

An active seating system is helpful in these cases. Sometimes just awareness of your seated posture is enough to alert you to tense important muscles for better support and comfort.

Children, who are not able to tense their muscles intentionally and purposefully, often need external assistance.

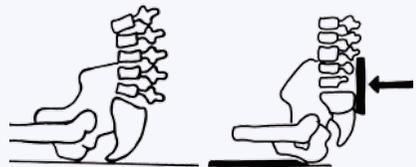
The shape of the seating surface or the support of the pelvis and back area may be crucial here.

Options

(which can and should be combined with each other):

- abductive sitting or, if possible, saddle sitting, or sitting on a roll
- contoured padding in the seat bone area (deeper cavity at level of the ischial tuberosities) in combination with an iliac crest support, which supports the pelvis
- open hip angle (active sitting)

- a) without pelvic support
- b) with pelvic support



Pelvic support

Asymmetrical postures / scolioses:

Asymmetrical postures in the area of the spinal column can be anything from very slight up to seriously, partly fixed scolioses. (See image on the left)

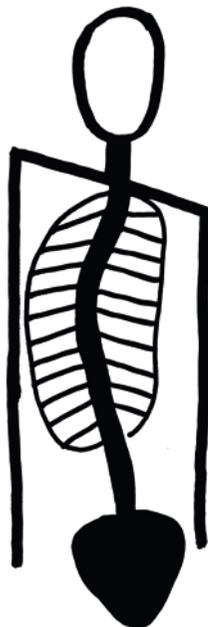
There are children who simply fall to one side because of low innervation of the muscles or impaired perception.

This often is due to perception disorders. If running a hand along the back muscles of these children or by applying punctual pressure to the erector muscles of the spine (in terms of the tapping acc. to Bobath) changes in the tone and better straightening can be achieved. Also stimuli applied to the sides of the trunk can help the children in finding the center of their body.

This appearance is not yet regarded as a functional asymmetrical posture.

However, children with these postures should be checked carefully in short intervals and stimulated and supported by

therapeutic intervention or the right seating devices. Very rigid seating devices that do not address independent movement or perception support are the wrong choice in such cases.



They simply fix the children's position, so they can hardly improve their own motor abilities.

If a child is unable to actively come out of the asymmetrical posture and presents a permanently curved posture or vertebral rotations, this is called scoliosis.

The severity of the scoliosis is analyzed by degree measurement. The following rules of thumb are used for therapy, and may give an approximate indication:

- ***less than 20°:*** regular physiotherapy
- ***more than 20°:*** regular physiotherapy plus a corset (TLSO)
- ***more than 50°:*** physiotherapy plus corset until the child is fully-grown, then perhaps a stabilizing surgery

These decisions are always up to several factors and must be made individually for each case. In any of these cases, regardless of the degree of the scoliosis, the back must be supported using solid materials. If freedom of movement is given in the trunk area the children "abuse" this to bring themselves back into the asymmetrical posture.

A super extended neck or poor head control:

First one must distinguish between an active overextension of the spinal column and neck, and the limply falling head.

The reason for the super extended neck is a motor disorder, which causes too much tension in the back muscles. When lying down, the children bend like a bow. When sitting they bend their head backwards again and again trying to super extend. It is very important to find positions allowing the children to relax. (s. fig. a)

Special headrests, possibly in combination with shoulder harnesses, can be helpful, too. A child, whose head continually falls backwards limply, indicates low muscle

tone in the entire trunk. The pelvis is tilted backwards, and consequently, the back bends strongly and the head seems to super extend. In fact, the head adapts itself like this to prevent the center of the body from shifting too far forward. (s. fig. a)

In these cases it is crucial to optimize the position of the pelvis and spinal column. Furthermore, it is very important to improve tone by providing sensory stimuli.

The goal should be to support the independent activity of the child rather than holding the head in a passive way.



a) super extended neck



b) poor head control

Dynamic and stable – the best position is the next one

In conclusion, I would like to talk about what it means to help children with disabilities or physical limitations sitting as actively and dynamically as possible.

We have seen which orthopedic problems or general issues have to be considered to select an appropriate seating system. The children are being straightened up, kept upright, positioned symmetrically, or supported laterally.

All of those actively involved in the supply of assistive technology are familiar with these end results. However, these terms all assume that humans are passive by nature.

All of this is done with the children – the question is: What are they actually doing themselves? Are the children being seated, or do we want to help them to seat themselves as well as possible? And, what do they need to be able to do so?

The focus in selecting the best possible seating system is normally based in achieving an orthopedically correct, symmetrical seated position. In the best case, one may also consider whether this seating system fits to the child's environment and everyday life.

When positioning the child in a seat, frequently the tendency is "to play it safe". To make sure the child won't "slip" into any non-physiological positions, they are held at various areas of the body, supported, and fixed with belts and harnesses.

But how does it actually feel to be kept in the same sitting position for as much as 5 hours? Only a few of us can answer this question, because we never had to experience this ...

Please monitor yourself: How often and for how long during the day do you sit completely physiological, upright, and correctly? Our spinal column and thus that of our children, too, permanently requires little movements and changes in the position to maintain its function. Our muscles need this interplay of tensing and relaxing, too, to work properly.

In office furniture, car seats, or school chairs, this is already discussed and put into practice. However, the main focus in the selection of medical assistive technology is still on static positioning.

Children with special needs surely need to be supported in seating.

There is no question that children with special needs often need to be supported in seating. However, perhaps this must not always be done in a purely static and fixed way ...?

It is not my intention to criticize static seating systems in general. Of course, there are illnesses or circumstances requiring just these systems. I only would like to see that people think more about how to activate children and which seating devices should be offered that allow them to keep themselves upright independently. And last but not least we should make them feel comfortable.

**Children with special needs
sometimes need more support
to tap their full potential**



**Supplying a proper seating system
may create the basis
for the best possible autonomy and activity.**

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