

Craft Research
Volume 12 Number 1

© 2021 Intellect Ltd The Portrait Section. English language. https://doi.org/10.1386/crre_00043_1

Received 2 October 2020; Accepted 4 December 2020

THE PORTRAIT SECTION

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There and back again: A carver's tale of losing and regaining sense of space due to a brain tumour

Keywords

sense of space
brain tumour
woodcarving
experiential account
autoethnographic
narrative inquiry
craft

Abstract

Sense of space is a core cognitive ability necessary for imagining future three-dimensional forms, rotating them mentally, as well as for abstract thinking. It is a core ability in craft activities, enabling the maker to ideate and envision their ideas. This autoethnographic narrative inquiry presents my experience of woodworking whilst a brain tumour impeded my sense of space. The narrative describes my experience of losing and regaining this ability and the actions I took to continue carving anyway. The article's evocative narrative exemplifies how the core identity of being a carver and the carving process itself function

as coping mechanisms in the face of terminal cancer. The article's main purpose is to generate knowledge on the role of spatial skills in carving and their elusive nature. Theoretically positioned in the field of embodied cognition, the article explains how our sense of space develops in interaction with materials and our surroundings. It also suggests how future education can be changed by purposefully incorporating targeted craft practices to better support the development of a sense of space.

Introduction

This article presents an autoethnographic narrative inquiry of my experience of woodworking before, during and after the surgical removal of a brain tumour, along with my reflections of living with terminal cancer. I am an experienced carver and craftsperson, having been an artisan for more than three decades. I am also a scholar and teacher of craft, and professor in cultural education and aesthetic practice, studying carving from sociocultural and psychological perspectives while incorporating neuroscientific knowledge (Gulliksen 2017).

I had designed a one-year research study of my own carving process while making bowls in my *Purkinje Series* (see Figure 1 and Gulliksen 2018) before the tumour started growing. The onset of this disease presented an unexpected opportunity, as during the course of a few weeks the tumour caused me to lose my ability to ideate three-dimensional forms and mentally rotate objects. After surgery, this ability returned.

Theoretically, this work is positioned in the field of embodied cognition, as I draw on the embodied mind and discuss material interaction and the relationship between my sense of space, the mental rotation of objects and movements when practising my craft. My research question, developed *post facto* during the analysis and writing of this text, was: 'How do I, a woodcarver, experience losing my sense of space, in particular the ability to ideate three-dimensional forms and mentally rotate objects?'

Methodologically organized as a case study, I documented this lived experience through several means from 15 December 2017 to 6 April 2018 (see Figure 2). I captured think-aloud accounts (Groth et al. 2015) in five video-recordings (total length >40 minutes, transcribed to eleven pages) and audio-recordings (total length >35 minutes, transcribed to twelve pages). Additional documentations included written notes and correspondences describing the experience (total twelve pages), still photographs (total >200 images) and medical data (operation descriptions and MR images). Prompts and timings for the think-aloud accounts were developed together with experts on both video documentation and neurobiology. As I was studying my own brain with my own brain, it was critical to find ways to include an outside perspective; thus, I used the video-recordings of my



Figure 1: Gulliksen, 2008. Two finished works in the Purkinje Series, the ones carved in this narrative. From the left: Purkinje#3, Purkinje#2. © Gulliksen. Photographer: Marek Podowski.

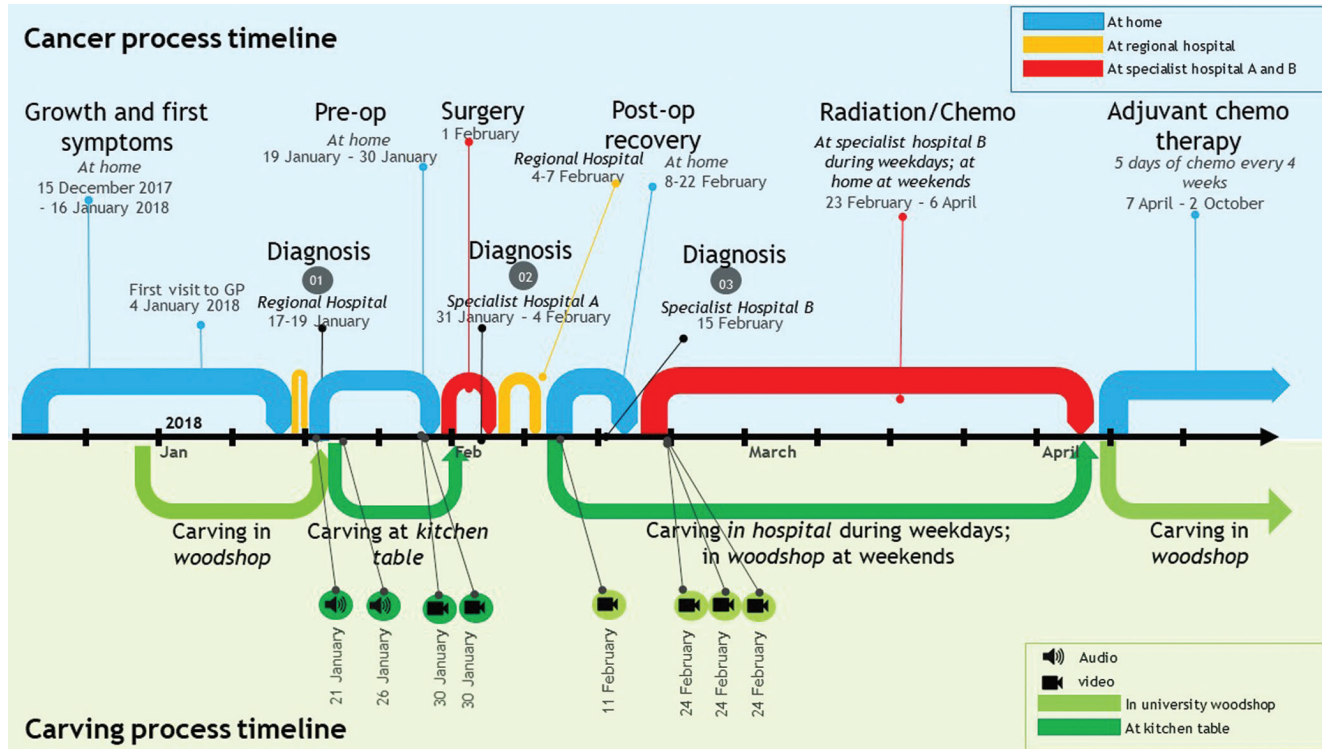


Figure 2: Timeline covering the cancer and carving processes.

carving sessions before and after the surgery to document my actions. In these, a trained eye can identify hesitations, errors and other indications of the missing sense of space in action.

The material was analysed using the NVivo12 qualitative software. The first set of codes was developed based on relevant literature (top-down), refined and checked for intra-coder reliability in discussion with colleagues. Intra-coder reliability was controlled by coding the same document twice, three months apart. Some improvements were made (bottom-up) for clarification and to reduce overlap between nodes. The final key nodes included *emotions*, *other mental activities*, *physical activities*, *sense perception* and *support actions*. Explicit node descriptions were developed, refined and controlled for overlap, including benchmarks for inclusion.

In cross-referencing images of my woodcarving with the video- and audio-recordings and analysing written notes, the coding process awakened my memory of the lived experience, facilitating the identification of critical incidents and supporting this autoethnographic narrative's development. This analysis guided my writing to ensure that the article, almost two years after the events it depicts, presented the process as it unfolded and to limit the influence of my reconstructed memories. Using the autoethnographic narrative inquiry format, the text is written to evoke recognition and empathy (Ellis and Bochner 2000: 744) and extract meaning from what happened (Denzin 2014: 36).

This text represents a seized opportunity. Instead of passively being subjected to my diagnosis, I actively engaged in carving and found ways to capture how the tumour impeded my sense of space. In hindsight, the deliberate activation of my combined core identities as researcher and carver probably was a necessary means to keep going whilst facing terminal illness. As such, the article's evocative narrative exemplifies how my core identity of being a carver and the carving process itself function as coping mechanisms in the face of terminal cancer.

The journey begins

Here I was – one dark day in late December – heading uphill to the university woodshop with a heavy chunk of aspen wood in my backpack. Under my feet, the early, thin sheet of snow cracked. The stars shone, uncertain in the crisp winter air. Entering the warmth inside, I manhandled my heavy aspen burden and my carving tools up onto the bench. The log's bark was cold and soft, with coloured splashes of lichen sprawling on the grey bark. For some twenty years I had researched other people's carving. Now, at last, it was time for me again to study my own making process. I looked forward to this.

As I secured the wood to the workbench (Figure 3), I planned how to document my craft practice to be able to study it later. I had to rig a camera and microphones and plan when and how to do think-aloud accounts to elicit knowledge of the carving experience. I was also deliberating the research focus for my autoethnographic study. These first days in the woodshop should be warm-up



Figure 3: Gulliksen, 30 December 2017. The journey begins. © Gulliksen.

exercises, getting ready. The specific research focus could come later. Using the spokeshave to gently pry off the bark, I began.

My general artistic idea was to make sculptural bowls inspired by neurons: a small bowl in the middle, a thin axon at one end, a cluster of dendrites at the other. Visual representations of Purkinje cells in the cerebellum fascinate me, especially the lovely artistic drawings of pigeon Purkinje cells by Ramón y Cajal (1899). Now, I planned to make this one log of aspen wood into two Purkinje cell-inspired sculptural bowls. They did not need to be scientifically accurate. The bowls were, after all, 40-something centimetres long and made of wood. I wanted to explore my limits in three-dimensional ideation and carving, taking artistic liberties with the dendrites, letting them playfully meander over and under each other like branches or roots of the tree itself. Therefore, I looked for as complex lines as possible to carve into my piece of wood. That was when I realized for the first time that something was very wrong.

In the weeks leading up to this point, I had experienced some instances of vertigo and disequilibrium. The symptoms were vague in the beginning. The first time I noticed them, December 15, I was suddenly dizzy while saying goodbye to a group of students at the end of an intensive one-week Ph.D. course that I had taught. I wrote it off as end-of-term stress. Exactly one week later, it happened again. Stronger this time. I was in my living room, watering my plants as I do every Saturday, and suddenly I could not find the pot, resulting in watering the shelf and sofa instead. Bewildered, I sat down and found dark stripes rolling downwards across my right eye, like an old television screen reloading and reloading its image. Later, I would come to realize that the flickering image was in my right visual field, not my right eye. I also felt distanced from my right hand and had trouble finding the letters on my phone when trying to type what I felt. I was tired for an hour or so afterward. Not yet too worried but instead fascinated by these experiences, I repeatedly, deliberately, reached for objects with my right hand and measured with my left index finger by how far I missed. I found that my right hand consistently reached fifteen centimetres to the right of an object.

I had not yet linked these seemingly unrelated incidents to anything of relevance to my woodcarving, besides their making me unusually tired. Well, and the fact that I sometimes had one hand fifteen centimetres misplaced, which could be somewhat dangerous when the perceived end of my hand ended in a sharp woodcarving u-gouge (a grooved chisel).

I have previously used the perception phenomenology theory from Merleau-Ponty (1962) to describe and explore how my woodcarving tools are included as parts of my own body when working (Gulliksen 1997). Lately, I have also read fascinating published studies exploring the neural processes behind this phenomenon. They argue that what we sense with our tools is processed by our somatosensory cortex and experienced similarly as other forms of touch (see, e.g., Miller et al. 2018). So, even if I had been surprised earlier, and even astonished, when my tool turned against me and – in the blink of an eye – cut my finger (Gulliksen 1997: 67), I now encountered an even more

hazardous consequence of this phenomenon, as I sometimes misjudged where my right hand and sharp gouge were. It took a lot of effort to not cut myself more severely than small nicks.

Gently as a snowflake falls on my shoulder

The day I first called my doctor, I was in the drudging yet exuberant first stages of woodcarving: the stage just after the log has been coerced to split by wedges driven deeper and deeper into the wood. Leaving my muscles shaking, sweat drops running under my sweater, finger-thick chips of sap-dripping aspen wood flew through the air, the rhythm set by the loud cracks of the mallet. Beneath this insistent pounding, drowned to bare whispers, were soft taps of chips falling to the floor. Cold, wet chips, tickling my bare toes (Figure 4). As I dug into the wood of my first bowl, Purkinje#2, and started to develop the main lines, the symptoms snuck up on me as gently as a snowflake falls on my shoulder.

My hands glided over the wood, easily marking curves. I put the workpiece on the bench and ideated. 'Where do the ends go down to the table surface? Where will the negative space be, under the bowl and between the dendrites?' I marked out with my grey and brown pencils, pushing hard, making bold strokes. 'This part should be cut away next.' Lifting the piece up again to secure it on the bench, I stumbled. Again. 'It is nothing, I am just a bit unsure. Where should I cut again? Right, here's the brown marking. This part should be taken out.' I trusted in my brown marks, cut some more. Repeated it again. Drew another mark. 'Oh, this log is heavy. My arms are weighed down with lead.' Turn. 'Where was I? The brown mark is going this deep on this side?' I used my finger to measure the height on one side, then the other.

I copied the shapes onto a piece of paper and cut out a template (as seen in Figure 4). 'This will be useful now; oh, it is so difficult.' The next part of the carving was the bit I looked most forward to; when the detailed outline – until now seen only on the top of the piece – is extended to the sides, and underneath. In this most complex part of carving, the ideation of a three-dimensional form will start in truth, as shapes from the front are continued around the piece, drawn as prospective new structures below and between. I usually relish this part of carving, letting myself sink down, immerse, ingest the rich, succulent depth of the heart of carving. But now it simply fell apart. I turned and turned the wood, just making myself dizzy. I got lost at once. I held my finger at a correct angle, turned it in sync with the bowl. 'Yes, there – no.' Lost again. I took the paper template and held it to the window, drew the mirrored image on another sheet of paper, making another template before returning to the workbench. 'Yes. At last.' I pinned the forms down on these mental crutches of paper, copying instead of ideating. Carving in this phase is usually glittering, thrilling, exciting, a ripe fruit to devour. But now it was like a dried prune, deflated and grey. 'Get on with it.' Frustrated and slightly nauseated, I started carving the other bowl instead, Purkinje#3. I made sure to make this one simpler, with a less complex shape: fewer lines, fewer overlaps and twists (Figure 5). 'I am so tired. Why are my tongue and right cheek tingling?'



Figure 4: Gulliksen, 4 January 2018. Purkinje#2 and wet wood chips around my toes. © Gulliksen.



Figure 5: Gulliksen, 9 January 2018. Purkinje#3. © Gulliksen.

Looking back, the depth of my denial of the severity of my symptoms and how much they influenced my carving is uncanny. My GP had at this point not yet mentioned that there might be anything wrong with my brain. Instead, she arranged for an EKG and vision tests. Only after ten days of these other tests was I sent for an MR scan of my brain. The nearest MR machine is in a town half-an-hour away. I took the bus alone, walking deliberately, slowly through the snow. Afterwards I was told to wait before leaving, and I sat in the packed waiting room looking outside as the short January day darkened. People came and went. Pools of dirty snow slop-melted on the floor. They let me see the picture of my brain (Figure 6), a tumour the size of a golf ball clearly visible. They did not give me a name for it or an explanation, only told me to get myself directly to the hospital for more tests. Seeing this image on my retina, for the first time, I felt nagging, cold tendrils of dread clawing at my gut. I called my husband to come fetch me. He and I drove the two hours to the nearest hospital between snow-burdened trees that smothered us in silence and darkness.

Experiencing a brain tumour: Being there

Avoiding the problem: The loss of the three-dimensional form ideation skill

My world shredded to pieces, but I returned to my carving as soon as the hospital released me. I have always been the busy professor, engulfed in my work, and like a heavy oil tanker running full steam ahead, I could not stop doing what I loved. I do not think stopping even occurred to me. I had planned to do research now, so I got on with it. It probably also functioned as a way of turning a blind eye to my suddenly dire future, engaging in a familiar activity, a lifeboat to cling to. I guess we all do what we have to do to get by. With a bag of medicines against oedema and anxiety, I was to wait at home for a surgery date. 'Try to relax', they said. 'Enjoy these days and make good memories for your family', they said. Ominous words ringing hollow as I sat at the kitchen table, January 19, two days after the MRI, gently opening the plastic bags containing my two poorly made bowls and scrutinizing my little wooden pieces.

Only later, when analysing the material thoroughly, could I see the true situation and what it entailed. Instead of returning to the woodshop, keeping the piece stuck on the workbench, standing upright and putting my entire body behind every cut with the gouge to make those big chunks of wood fly, I sat down, holding my bowls gingerly in my hands. I realize now that I had also experienced a problem with space before the formal diagnosis: when I stopped working on #2, the more complex bowl, and instead moved on to #3, the easier one. What I love most about carving is the ideation of a future shape, a bowl, a spoon, seeing a sculpture within a piece of wood (Laamanen 2016). I choose logs based on my own ideas, ready, eager to change both, mould them into what the unique growth of each individual piece of wood will allow. Visible when the bark is peeled off, when the log is cut in two, are the echoes of the tree's history, cold and warm weather, cut branches grown

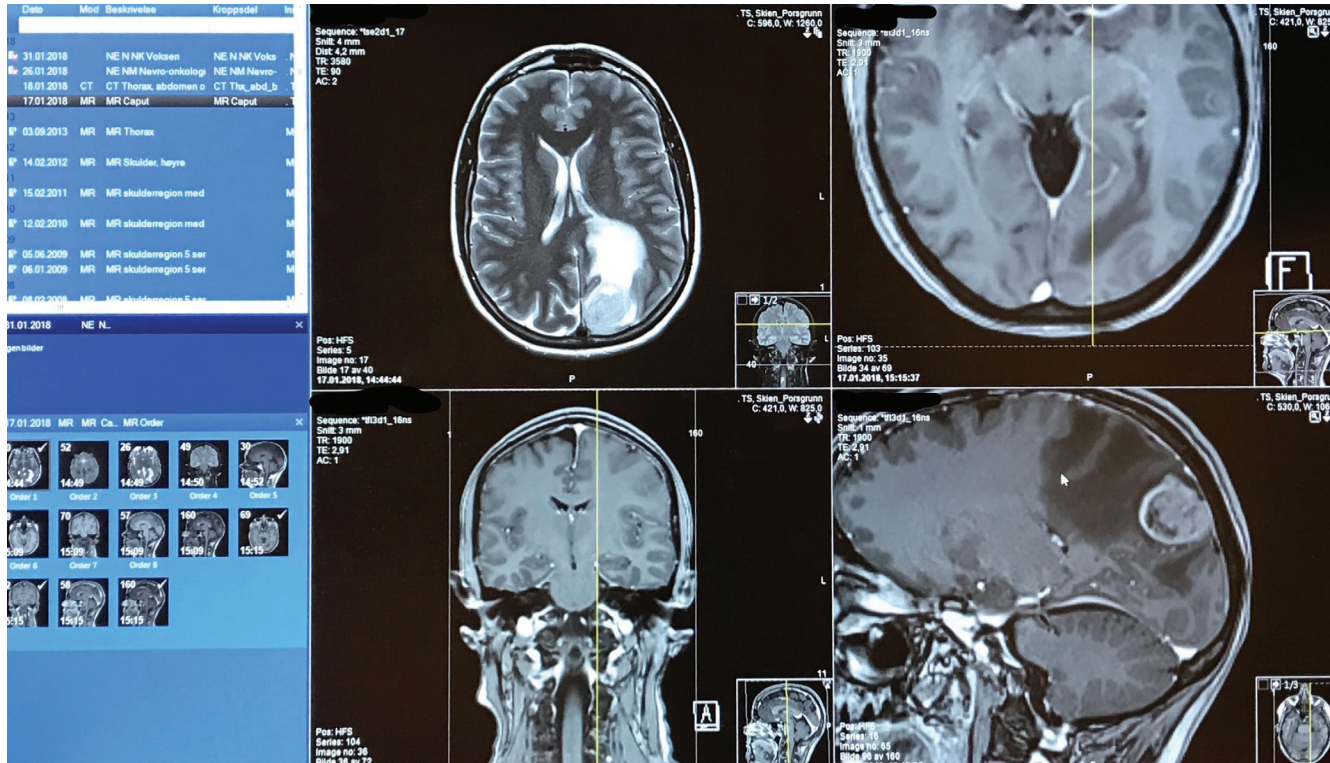


Figure 6: Gulliksen, 17 January 2018. Screenshot of MR image of my tumour.

over, nutrients drawn upward from the ground (Nassar and Barbour 2019). When I carve, I carry on a dialogue with my piece of wood, my bowls-to-be. I negotiate between a particular piece of wood and my ideas, resulting in ever-new, revised ideations of a future three-dimensional form. There is no place for regret. Woodcarving is a subtractive activity: after a cut is made, there is no uncutting it. If I accidentally chip off a corner, that corner is gone. If I cut too hard across the grain and the wood splits, I just need to deal with it: revise the ideated three-dimensional form, make a new plan. Normally, I love this process, but now I was just avoiding it.

My tumour was nestled between my somatosensory and visual cortices in my left cerebral hemisphere caudal to the chiasm. The resulting oedema sprawled all over both cortices. This gives a clue to my troubles. In the book *Making Space – How the Brain Knows Where We Are* (2014), neuroscientist Jennifer Groh describes what she refers to as sense of space. This sense includes so-called mental maps of our surroundings, which have both a mental and a physical meaning. To me, a woodcarver, this theory of cognition as embodied (see, e.g., Kiefer and Trumpp 2012; Shapiro 2014) has proven useful for a long time. As Groh (2014) argues, there seems to be consensus that the somatosensory and motor cortices are each dedicated to processing input and output from specific parts of our bodies. Input from these areas is translated and integrated with visual and auditory stimuli to allow us to understand space and our place in it (Groh 2014: 67). Their close cooperation is necessary for us to navigate the world. Indeed, the somatosensory system is more important for adjusting movement than for our perceptions, as Mason (2011: 425) explains, and the visual system is critical to the mental rotation of three-dimensional objects (Paschke et al. 2012).

Further, the same cortical areas that support movement in space are active when we simply imagine moving ourselves or objects in space. These mental maps provide us with our spatial skills, used all the time in our everyday life, in mundane tasks such as organizing our sock drawers or parking our cars. We also use our sense of space implicitly in abstract thoughts and notions: being near our loved ones, how we fit in a situation, being an underling at work. Our episodic memories and knowledge are likewise stored in our mental maps, as Groh (2014: 189–90) formulates: ‘not only is memory an integral part of building a sense of space, but space in turn serves as a kind of filing system for storing and accessing memories’. Thus, memories and abstract thoughts can be said to piggyback on our sensory experiences of the situation’s context and what we did, how we were acting when the situation occurred. This cognitive function is why it is easier to remember what it was you were going to fetch if you return to the place where you first thought of going to fetch it (Groh 2014: 3).

Schilhab (2017) uses the term *material anchors* in memory when discussing how we understand and read a written text. She expands with, ‘[t]he reading activity “speaks” to us at several levels: the sensory, perceptual, motor, conceptual and affective level. All of these levels participate in forming the so-called neural correlate, which is the bundle of neurons active during the reading’ (Schilhab

et al. 2018: third paragraph). In numerical processing in mathematics, spatial cognition is likewise important. For example, Goodman et al. (2016) found that manipulating physical objects to solve a task made it easier to solve digital versions of similar tasks later, and Crollen and Noël (2015) describe how low visuospatial abilities can lead to decreased accuracy. Spatial skills differ between individuals and are learned and strengthened through experience (see, e.g., Maia 2009). This embodied cognition theory leads to the notion that physical interaction with materials facilitates neural networks that support our sense of space, as used for concrete and abstract thinking (see also, e.g., Harpaintner et al. 2020).

When I do three-dimensional ideation in my woodshop, I am using, quite explicitly, my stored memories of previous three-dimensional situations to make virtual templates for how each of my actions will change the wood and to know where my next cuts need to be to develop my planned form. It is an activity specifically drawing on combined spatial understanding and mental rotation skills. All of this requires a part of my brain that now housed a tumour. No wonder, perhaps, that I had to turn to paper templates as mental crutches to guide my carving. No wonder, perhaps, that I turned away from the more complicated bowl and worked on the easier one.

If my first reaction, when experiencing the loss of my mental rotation ability, had been to change from the more complex Purkinje#2 to the slightly less complex Purkinje#3, my next reaction was to avoid carving big chunks, prematurely pausing the main form development and just doing my best to navigate and adjust the forms already excavated. As a seasoned carver, I would never normally have done such a thing. The bowls were not remotely near a point where such surface work would be logical. I had deliberately chosen this as a temporary measure. I carved each piece to a point where it could dry in peace, crack and warp, if necessary, and then I could return to it later. It is possible to see the aftermath of this choice in the finished objects. Purkinje#2 and Purkinje#3 are more solid than the bowls made afterwards, especially compared with Purkinje#6, made one-and-a-half years post-surgery, which in just a few half-days of effective carving had proceeded much farther than the first bowls in three tumour-filled weeks (see Figure 10). But I get ahead of myself.

Being there, but not being present

I carved as I always had. Yet, I carved as I never had. I was present, and I was not. I did not see, really. Not with my eyes. I saw with the skin on my fingertips, I saw with the sharp end of the gouge. The grain, bumps, wood chips gently poked my skin. As I smelled, touched, saw and did, fog clouded my awareness and I felt distant from my hands, from what I was doing. My presence was suddenly less, well, present. Was I here carving, or was I somewhere else? Was it me carving, or was I watching a third person carve?

I kept getting lost when I changed the position of the gouge's edge, my hands, the object or my gaze. This happened several times in these sessions before surgery. My world would suddenly turn, actually lurching to the side, in-head earthquakes, setting my vision spinning or twisting my thoughts and setting them running aimlessly round and round like scattered grouse in hunting season. I had extra light from a lamp at my right to emphasize shadows and thus show me the finer texture of the wood. But this light also triggered symptoms and made my eyes hurt. Of the four documented carving sessions in this pre-surgery phase, I ended two because of too many symptoms. Whether they all came from the tumour, I still do not know.

I carved with tight lips and white knuckles, and when I remembered to think about it, I realized that my breathing was shallow and my shoulders were up around my ears. Towards the end of each session, I got fluttery, moving the object around, carving on one side and then another. This was a self-perpetuating cycle: when I got tired, I lost focus, and moving from one place to another triggered symptoms, leaving me even more tired. In the last video-recording before the surgery, towards the end I talked slowly. Cut slowly. I sometimes carved cross-grain without seeming to mean it, appearing confused and searching for places to carve. Sometimes my movements looked fretful, flimsy, searching. I could still carve, but barely. I seemed to keep a flow in carving only when I maintained focus on one single place. Rotating the object overwhelmed me, and my mental focus could not keep up. All major changes in three-dimensional form I simply avoided and saved for later.

Back again

Getting back on my feet

I would not say I bounced back. But, by the eleventh day post-surgery, I was feeling good enough to return to the woodshop at the university. Just this choice of place to carve speaks volumes. I could have chosen to keep to my kitchen table, sitting down, whittling along and making those small dainty chips. But no. I walked laboriously up the steep climb to the university campus. The path was now filled with thick layers of snow hiding treasonous patches of ice beneath, remnants of thaw long gone. I headed for my office first; the recliner chair gently wrapped its arms around me as I sank back and closed my eyes. World turning, head buzzing. I breathed. Felt the air gently touch my lips: cool going in, almost indiscernible, heated up to body temperature when exiting. Ribs expanded, relaxed. Gently. Sunday quiet in the halls. The stone floor stairs echoed dully in the dark hallways as light sensors reacted, stabbing sharp light into my fragile eyes. I took my time, slowly positioning the carving gouges and my colour-coding pencils (Figure 7). The lumpy, heavy and thick aspen Purkinje#3 thudded dully on the bench.

I dove right into the thick of it, using a mallet to hammer my gouge deep into the wood. 'Oh, I have been longing to do this!' I used the brown pencil to mark the main outlines and kept to big



Figure 7: Gulliksen, 11 February 2018. Getting ready in the woodshop 11 days post-surgery. © Gulliksen.

areas. Areas where much material must be taken away. Dry like last year's firewood, my bowl-in-progress resisted me. Hard splinters accused me of not working hard enough. Some of the cracks that were there earlier had shrunk in the drying process, so I did not have to change my plan much. I put my weight on the gouge, used both hands. I had no problems coordinating my arms or the gouge. I knew where I was, where to carve, where the sharp edge was. I dove into this experience: 'Yes, it feels like "me", this is what I know. This is what I am used to doing'. The wood chips flew off, following my lead; and gently, the main shapes were revealed. Each chip of wood smooth to the touch, fully dried up. The aspen wood's inner glimmer, looking like mother-of-pearl in the right light, made each chip into a small gem smooth enough to embellish a pretty neckline. Held in my fingers, they disintegrated into fragments. I could find the wood growth easily. 'This is what I do. This is what I am.' Almost forgotten was the knowledge that just a few days ago I could not do this. I notice that my sense of space returned only when I actively looked after it, tried to talk about how I felt based on my prompts for the think-aloud accounts. If not for these prompts, would I have registered it at all? It seems that this ability is even more elusive now, being there, being right, than it was when it was not.

Listening to the think-aloud account afterwards, I noticed my gradually slower talking. More fragmented sentences, lower volume. Especially notable was my slow pace when I spoke aloud about the shape. I was clearly reduced at this point, but this did not seem to influence my sense of space as much as before the surgery.

Putting my ability to the test

The next six weeks will forever stay with me as extraordinary. If my life story was written as a novel, these weeks would be squeezed onto one of the pages as a freestanding textbox outside the narrative, separated by font size and colour and framed with a solid black line. On weekdays I spent long, silent days and nights in the hospital hotel two hours from home. Time was perforated only by brief sessions of radiation therapy, my head locked tight to a table by a light blue plastic mask. Hidden in the hospital's hobby room on the second floor, I, again, carved small woodchips. Dainty chips, like the ones I made in the kitchen. In the long evenings, my two bowls shared my loneliness. I held them tight, felt their forms, planned new shapes.

The first weekend at home during this unreal period, I went back to the woodshop, upbeat and ready. The bowls were by now filled with drawings made during those long nights at the hospital. The brown and grey pencil markings did not provide me enough information. I needed more succinct colour codes, so I used green and red pencils: green for outer edges, red for the middle lines of the forms. All markings giving pointers for where to cut and how much (Figure 8).



Figure 8: Gulliksen, 24 February 2018. Purkinje#2 as seen from below with red and green lines 24 days post-surgery. Still photo from video. © Gulliksen.

I did not want to carve too long because it tired me out, but I yearned for an opportunity to get some good, hard work done. A chunk of wood had fallen off underneath the first bowl, Purkinje#2. This day, I planned to find ways to incorporate it into the overall design and finish carving the main lines from beneath. These two tasks would put my sense of space to the test, coming as close to being an extreme sport as carving can be, unfeasible for me days earlier. Longingly, I mounted my camera on the selfie stick I filched from my son and got on with carving.

As natural as spring follows winter

I targeted a little canyon between three separate dendrites. These meandering dendrites were situated in different depths and flowed over and under each other. The biggest canyon to be carved was positioned so that I needed to cut cross-grain downwards, leaving cut, fragile cross-grain fibres on both sides of my cut. The workbench holding the item for me allowed two-handed carving. However, it also called for sharp tools and an even force on the carving iron. Each cut had to be ever so gently targeted at one slope at a time. A little too much force on the wrong place, or a little uneven pressure, could make the cross-fibres on the side fall off, destroying the shape further. I knew all of this from a technical perspective, and my sense of space now willingly permitted me to understand and visualize how this should be. As earlier, my fingers did most of the seeing, probing, analysing. The texture under my fingers revealed fibres and wood chips, bumps and dents. My fingers registered the relative distances between parts of the bowl, between the carving iron and the wood, and as I continued to carve and redraw the lines, I was guided by my sensorimotor negotiation and my generated small patterns of movement (Gulliksen 2020). Confidently I revelled in the burgeoning feeling of expertise. 'This is what I do. This is how it should feel, as naturally as spring follows winter.' My sense of space had been gone, and now it had come back.

Was I as confident as I thought I was, though? Although I was working on the hardest part of the hardest bowl (#2), it was a limited area. There was no hesitation as I switched between sides of the little dendrite bordering the canyon. The video stills in Figure 9a–c are only seconds apart. Notice the changing angle of the carving iron and the changing position of my body.

Still there was this lingering memory of problems, a slight echo of past misunderstandings, pulsing in sync with the dull cotton-muted throbbing in my head. Did I perhaps use a less-than-perfect iron for the task? Did the sounds from the carving suggest that I was carving more cross-grain than is ideal? Why was I changing my grip and angle so often? The quiet, steady calm of carving was missing in the very last video-recording. I worked here, there, fluttered between places to carve. But what could I have expected? I guess that the benchmark of confidence might not be the same now as before. I had just been through brain surgery; I was exhausted, in pain and facing death. Yet, the last thing I did before turning off the camera on this last video was look straight into the camera and



Figure 9: Gulliksen, 24 February 2018. Stills from video: (a) 00:09:08, (b) 00:09:10, (c) 00:09:13. © Gulliksen.

smile. Only a shy, twisting upward turn of the lips with my eyebrows raised high and worry wrinkles creasing my forehead. But it was a smile.

Looking back and going forward

My sense of space had been gone, but now it was back. In this autoethnographic narrative, I circled around the question: 'How do I, a woodcarver, experience losing my sense of space, in particular the ability to ideate three-dimensional forms and mentally rotate objects?'. The text itself includes several sensory perception issues, sensorimotor symptoms and visual symptoms. There are descriptions of the actions I took to continue anyway, of my haptic sense becoming increasingly important, the active use of templates, colour-coded pencils and other mental crutches and, not least, the several strategies I undertook to avoid problems. The text also describes how perceptual issues caused problems for me in identifying the wood's grain direction and ideating three-dimensional forms and how trying to work through these problems increased all my symptoms. Towards the end, the narrative shows how my perception returned to a seemingly normal state. A year later, I could carve very intricate forms (Figure 10).

For me, a woodcarver, spatial skills are core competencies in three-dimensional ideation, the prospective thinking and visualizing of future forms and rotating them. They are integrated in my professional expertise. The article exemplifies how the somatosensory and visual cortices of the brain are used in three-dimensional form ideation and woodcarving through descriptions of how I experienced them not working when they were affected by a brain tumour. It is not the purpose of this text to go into a deep discussion of these neurological processes, which would demand more theory on the neuroscientific side of the issue. However, due to my special circumstances with the tumour infiltrating the parts of the brain involved in spatial skills, this narrative, which emphasizes the actions I took to overcome and circumvent my missing cognitive ability, makes it possible to infer insights into how this ability is actually used in practice, when carving. Further, the article's narrative highlights how hard it is to be aware of having, losing or not having spatial abilities, indicating a possible core challenge for future research and society.

We cannot envision something we cannot conceive

The experience of losing an ability was hidden in the complex mesh of anxiety, medication and general brain cancer symptoms. It hid in the tacitness inherent to a non-verbal skill (Polanyi 1966) and the tight integration of my abilities and me within my identity. Tangible to me only because of its previous absence, I could grasp my ideation of the three-dimensional form and mental rotation



Figure 10: Gulliksen, 2019. Five finished bowls in the Purkinje Series. Below: Purkinje#4; on top, from left: Purkinje#5, Purkinje#6, Purkinje#2 and Purkinje#3. © Gulliksen. Photograph: Marek Podowski.

skill when it returned. Therefore, the narrative shows the consequences of the missing ability, not the missing ability itself.

As previous research suggests, all persons have different levels of mental rotation skills, different proprioceptive skills and their own individual mental maps and sense of space. While some have extraordinary dexterity, like the famous violinist and composer Paganini, who drew on his skill to make music other composers would not have considered and that very few are able to play (Nelson 2011), we all have limitations in dexterity, even if these limitations are elusive from our conscious selves. I came gradually to an awareness of my abilities when I lost them: my sense of space suddenly tangible, accessible, because of its absence. Together, our cases exemplify how fragile and prone to bias our conceptions are, how they limit or facilitate our perspectives, our ideations, our imagination. In a future world of robotics and artificial intelligence, everything may seem possible to create and experience. But not everything is possible. We cannot envision something if we cannot conceive it.

Scaffolding and supporting spatial cognition, therefore, may be even more important in the future. Humans are expected to increasingly navigate in a virtual world while our everyday lives provide less and less physical interaction. This can have unintended negative effects. For example, this presents us with a task performance deficit (Goodman et al. 2016), which, at some point, we will need to address and strive to reduce or counter. Physical interaction with actual materials both activates and creates the neural networks facilitating our abstract thinking. Thus, it could be that purposefully training carving or other three-dimensional crafting and sculpting skills could be useful to promoting a sense of space and prove beneficial for grounding other mental skills. In light of this, carving or other crafts could be even more important subjects in schools than they are today, as they offer the types of physical activity that engage and develop the spatial skills that future societies will need. Carefully designing studies translating between knowledge of carving and three-dimensional form ideation in psychological, social or cultural perspectives and knowledge of carving-like or carving-relevant activities at the neuroanatomical level could be useful to conduct in future (Donoghue and Horvath 2016; Gulliksen 2017). It is my hope that the experiential account written in this article generates new hypotheses and paths for a theoretical analysis from several different disciplinary perspectives.

Acknowledgements

I would like to thank Professor Peggy Mason at University of Chicago for invaluable discussions over e-mail and Skype, and my colleagues associate professors Camilla Groth and Kirstine Riis for being sparring partners in the process. Lastly, I thank my loving family for letting me spend some of my limited time writing. I love you. This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

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Suggested citation

Gulliksen, Marte Sørebo (2021), 'There and back again: A carver's tale of losing and regaining sense of space due to a brain tumour', *Craft Research*, 12:1, pp. 127–152, doi: https://doi.org/10.1386/crr_00043_1

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