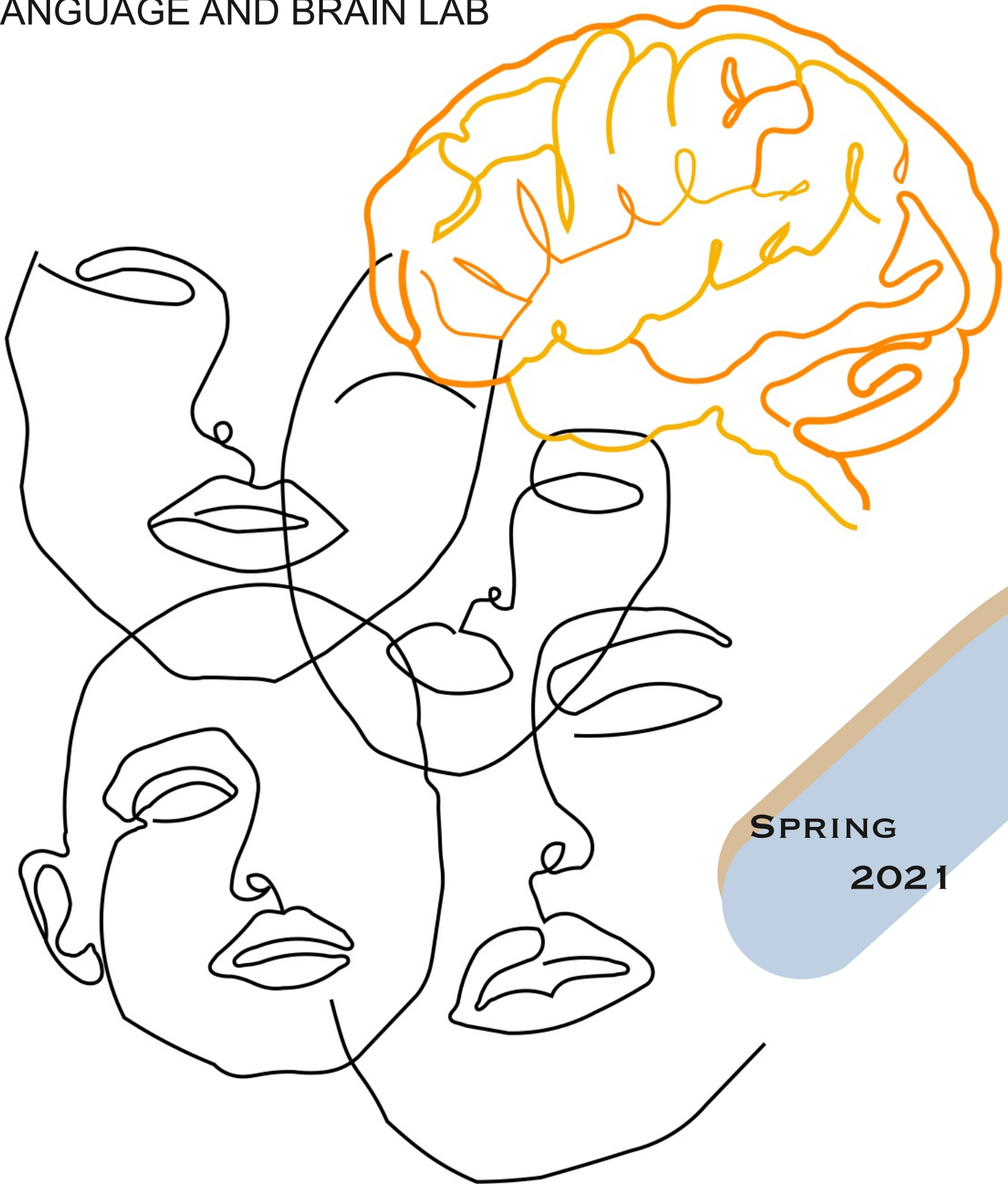


The Digest

LANGUAGE AND BRAIN LAB



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Bilingual Aphasia: What if a patient speaks *multiple* languages?

By *Sophia Arruda*

It's estimated that there are 45,000 new cases of bilingual aphasia each year, and that there are at least 200,000 bilingual individuals with aphasia total in the United States¹. For these individuals, language recovery can look a little different compared to their monolingual counterparts.

There are two theories on **what happens in the brains of bilingual and multilingual aphasia patients**. **Ribot's law** states that languages acquired at an earlier age are less vulnerable to degradation when brain damage occurs. On the other hand, **Pitres' law** argues that whichever language the patient used most before their brain injury will be the least affected by aphasia, regardless of when it was learned. While these are still relevant questions in the field, there is strong evidence suggesting that the earlier a given language was learned, the less it may be affected by aphasia. Language fluency and frequency of use pre-injury seem to have moderate effects on reducing aphasia symptoms. However, linguistic similarity between the two languages does not appear to play a role in this².

There have also been competing theories on **how language is organized in the**



brains of bilingual and multilingual individuals: the localizationalist view and the dynamic view. The traditional **localizationalist view** argues that languages are stored in different parts of the brain, and so brain injury location influences which language is compromised. However nowadays, this theory is more or less out of date³. The prevailing theory – the **dynamic view** – proposes that brain damage affects an entire language network in the brain, and therefore compromises all languages that the patient knows. The dynamic view – also known as the shared **bilingual neural substrate (SBNS) hypothesis**² – is better supported by research, and also explains most recovery patterns that bilingual aphasia patients exhibit³.

Case studies suggests that there are **seven main recovery patterns** for bilingual people with aphasia⁴:

1. **Parallel recovery:** both languages are impaired to the same degree, and recover at the same rate.
2. **Differential recovery:** each language is impaired to a different degree and recovers at a different rate.

3. **Selective recovery:** one language recovers, but the other remains impaired.
4. **Alternating recovery:** one language recovers to a certain degree, but then deteriorates as the patient begins making progress in their other language.
5. **Alternating antagonistic recovery:** the patient is able to speak one language on one day, but only the other language on another.
6. **Successive recovery:** after the patient completely recovers one language, they're then able to recover their other one.
7. **Blended or Mixed recovery:** the patient mixes their two languages as they progress through speech therapy.

But just how does knowing two languages impact the severity of a person's aphasia and their recovery? While aphasia occurs at the same rate in bilingual individuals as it does in monolinguals who experience a stroke, research suggests that language impairment in bilingual aphasia patients is less severe compared to that in monolingual patients⁵, and that this can directly be attributed to their multilingualism⁶, **potentially implying that knowing multiple languages protects against more severe cases of aphasia.** Not only is initial aphasia severity following a stroke less severe, but projected recovery time for bilinguals tends to be faster compared to monolingual patients⁷.

Knowing several languages has implications for treatment approaches as well. The evidence is mixed as for whether it's better to relearn multiple languages simultaneously versus one at a time. However, overall trends in the research suggest that rehabilitating the second language does not

negatively impact progress made in relearning the first. In addition, rehabilitation of a patient's first language can even promote relearning their second language, a phenomenon known as **cross-language transfer**⁸.

However, challenges can come with being a bilingual or multilingual aphasia patient. Finding a speech language pathologist who speaks the same languages as the patient can be difficult, meaning bilingual therapy is not always possible. Unintentional switching between the two languages can complicate therapy as well. In general, speech language therapy for aphasia patients often lacks robust bilingual resources. There is a great need for more targeted

interventions for this unique population.

But as globalization promotes multilingualism and longer life expectancies (and therefore more age-related illnesses, like stroke), scientists are beginning to appreciate the importance of researching the bilingual aphasia brain – not only for clinical purposes, but also to gain an overall better understanding how the healthy human brain processes language. **The field is burgeoning; promising new insights and treatments exist on the horizon.**

"THE EARLIER A GIVEN LANGUAGE WAS LEARNED, THE LESS IT MAY BE AFFECTED BY APHASIA"



A Temporary Normal:

An inside look at aphasia support and therapy groups in a pandemic



Interview with Dr. Jennifer Mozeiko

Dr. Jennifer Mozeiko is a speech-language pathologist, assistant professor of Speech, Language, and Hearing Sciences at the University of Connecticut, and Principal Investigator of the Aphasia Rehab Lab. Her research and clinical interests are focused on improving treatment and the quality of life of people with acquired brain injury. By Matt Phillips

What is the difference between an aphasia support group and aphasia group therapy?

If you look up aphasia group therapy online, you'll see that very often this term is used interchangeably with aphasia language support groups. Technically, however, **aphasia group therapy** is something that we need to bill for so it must have very specific treatment goals and documentation of progress to insurance companies. We run **language support groups** at UConn that are provided free of charge and our focus is not on individual goals so much as providing an environment that a) is a safe/comfortable place for someone to talk in front of others, b) includes people of varying aphasia types and abilities, and c) is fun so people want to come back. **Our groups are designed as a weekly social event to facilitate maximal language practice in a way that feels natural, not like therapy.** They are constructed of individuals who are newer to the world of aphasia and those with years of experience. The most powerful interactions are the ones that happen between group members and so our job as clinicians is to engineer these conversations and to facilitate successful communication.

Have aphasia support/therapy groups been able to continue meeting online during the pandemic?

Yes, we had our last live meeting on Friday the 13th of March, last year. The week after was UConn's Spring Break and we worked furiously to try and get each and every participant online when we resumed on March 27th. We had some technology resistant folks who decided not to attend for the remainder of the semester but several of them decided to join us when it was clear we'd be back online again in Fall. We have found that it's quite difficult for participants with the most severe aphasia types and we really need help from someone at home. Some groups, like our book clubs, however, run almost as they always did but without the snacks.

What challenges does meeting remotely pose?

There are so many challenges!!! For starters, there are some people who don't have an internet connection or a computer. We worked with a service that said that they provide computers for a greatly reduced price when need is demonstrated, so we filled out all of the paperwork and worked with families to

submit necessary documentation.

After several months of waiting, we finally received a computer for one of our participants; however, we were disappointed to find it had arrived broken. After multiple times going back and forth with the company to attempt to sub out different parts, and finally the whole machine, we still do not have a working device.

We have loaned iPads to some participants, but they needed to sit in a library parking lot in order to get internet access and then it was spotty. For those who had or were able to afford devices and connections, **there was a learning curve as they got used to logging on and meeting online.**

Right now, our biggest challenge is really the noise feedback we get from various individuals' environments. This is distracting for everyone but for people with receptive language difficulties, it is another barrier to access information, not to mention frustrating and annoying. We deal with this by assigning one student to keep all members muted. This has been somewhat successful in keeping noise down but, unfortunately, we cannot "unmute" participants on the app that we use so we need to ask people to unmute themselves. This is not always easy and by the time they do, they may have lost focus on the conversation. Despite all of this, I'd say there's general consensus that the groups are not as fun or effective as our live meetings but that they are "better than nothing!"

Have you noticed any benefits for meeting remotely for aphasia support groups or therapy?

There are a few benefits. One kind of nice feature of the online meetings are the breakout rooms. When we are in-person and break off into small groups, hearing the other small groups can be distracting. In breakout rooms, we get the benefit of the small groups without the distraction! **Also, remote groups allow us to host people who otherwise would not have transportation or who might need to miss for some other reason.** We have some participants who drive over an hour each way to get to us in Storrs, so this has saved them a lot of time! On bad weather

days, we often have to cancel groups. I'm expecting we will be back in-person next year but envision us having people join remotely when they can't make it and running remote groups on snowy days.

Has much research been done on the topic of telepractice for aphasia? What is the general consensus on its efficacy?

There's some research on telepractice in aphasia for one-on-one sessions and the general consensus is that the results are actually no different than in person. I find that hard to believe, personally, and wonder if selection bias is at play. There are fewer studies done on group treatment but, again, these tend to be positive and show a decrease in aphasia severity and increases in quality of life. These have not been compared with in-person sessions, however. In both cases, I think we need to be cautious with these results. They're positive for those who have access and who choose this method, but I don't think we can say that they're for everyone, yet.

How have you adjusted your research? It seems you do a lot of clinical research, which must be difficult to do with social distancing in place, especially with aphasia patients who are elderly.

My research has been greatly impacted as we have not seen a person with aphasia in-person for nearly a year now, except to set them up online. These are people generally over the age of 65 and with health vulnerabilities so we have been very cautious. We are now running participants online, but this really limits who we can see and almost always includes frustrations of some sort. On the plus side, we've been able to turn our attention to a wider participant pool. We definitely took a productivity hit this year but **I'm hopeful that the work we've put in will set us up to continue to run long-distance participants from their homes!**

Language Learning: The importance of *sleep* and *training* when learning non-native speech sounds

By Xinming Zhou & Laura Morales



Have you ever experienced a time where after getting enough sleep your memory gets better? Or on the flip side, maybe some days you did not get enough sleep and found it is hard to remember things? Both of these experiences are common phenomena. In fact, many studies indicate that **sleep is important for attention, memory, and other executive functions**¹. Studies related to memory consolidation in relation to linguistics have become a hot topic. Researchers are interested in whether sleep can help people learn a language or perceive the speech sounds of a language more efficiently.

As the number of bilinguals rise throughout the world, many adult second language learners report that they face difficulty perceiving or learning a second language's speech sounds. While previous studies discovered that sleep can help consolidate non-native speech sound perception, **we're interested in exploring whether sleep is a potential key component in facilitating non-native speech sound memory or learning.**

For some background, **phonetic sound** is the acoustic properties of a particular speech sound. For example, you say "cat" with the pronunciation /kat/. These written symbols are collectively called the **International Phonetic Alphabet (IPA)**²,

which consists of a giant chart of different sounds humans can produce and use as a standardized representation of speech sounds into oral language. IPA is generally used for all languages. For example, you can use IPA /kat/ to produce the word 'cat' in oral English. You can also do the same for other languages such as French, German, and Polish. You might be confused at this point because languages all sound different - how can they use the same rules? That is because the IPA chart selects the unique combination of speech sounds produced in different languages. By focusing on the sounds, it eliminates the issue of having to worry about grammar when transcribing (writing out the sounds being produced).

A current study³ conducted by one of our lab alumna, Dr. Fuhrmeister, found that **sleep may play a role in improving non-native phonetic learning.** The study trained and tested native English speakers on Hindi speech sounds, /dʌg/ and /ɖʌg/. A total of 63 participants (46 female and 17 male) participated in the study. The experiment contained two groups where both groups had relatively the same procedure receiving Hindi contrast training in the morning. Both groups began the experiment with a performance test

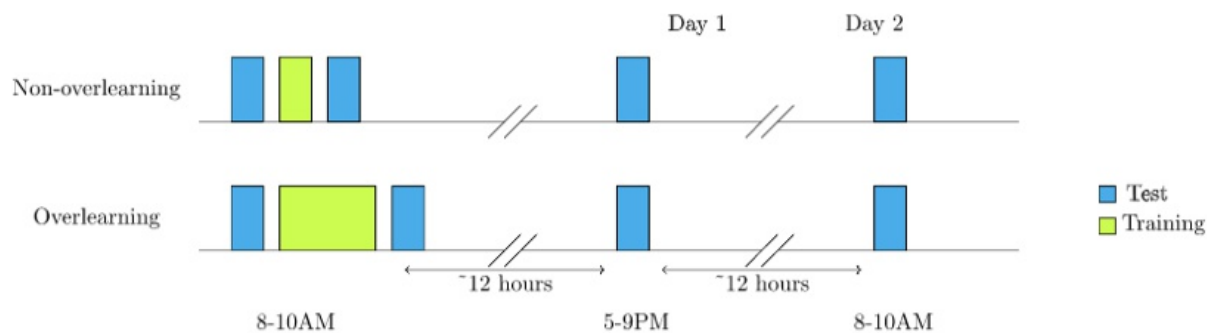


Figure 1. Depiction of study setup of both groups' (non-overlearning and overlearning) **testing** and **training** sessions.

that was then followed by training, then they were tested again, and then received two more testing sessions, 12 hours apart, after initial training. The only difference between the groups is that group 1 (non-overlearning) received *moderate* training on /dʊg/ and /dʊg/, while group 2 received *overtraining* on the non-native sound, meaning that group 2 continued to practice the task even after they mastered it [Figure 1].

Interestingly enough, contrary to previous work, researchers found that **both groups improved on the discrimination task after sleep**. Researchers also found that the group who overlearned showed the same level of overnight improvement on discrimination tasks as the non-overlearners. This suggests that **overtraining may not have a greater effect on learning**, as initially believed.

Figure 2 illustrates the performance of both groups on the identification and

discrimination tasks, possibly indicating that **sleep does seem to play a role in memory consolidation and learning, but it may be limited**.

The results of this study may suggest that overlearning does not help individuals capitalize on the sleep consolidation process when it comes to learning a new language. This study, however, as mentioned above, emphasizes the importance of sleep. Both groups were able to show a significant improvement after training and a good night's rest. These results elude to the conclusion that although overtraining does not seem to have an impact on language learning processes, sleep may be important for language learning, so be sure to get your Z's!

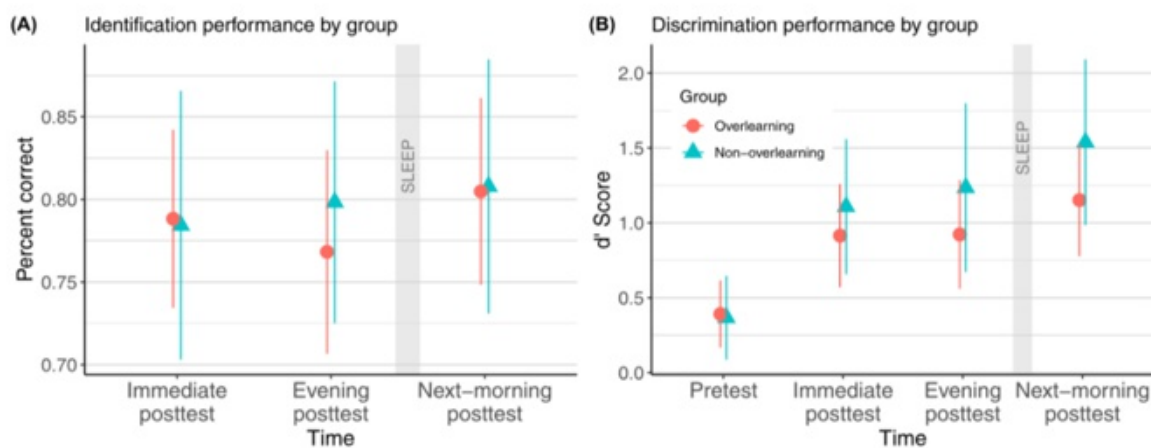
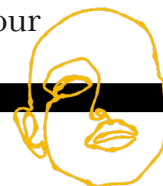


Figure 2. Both groups' (**overlearning** and **non-overlearning**) performance on the identification [Graph A; left] and discrimination [Graph B; right] tasks at the three testing points (Immediate posttest, evening posttest and next-morning posttest)

Get to know some of our

LAB members

By Lilly Mastrogiovanni

**PHOEBE
GASTON**

Postdoctoral Researcher - Psychological Sciences



Phoebe is interested in how people recognize words in speech, particularly how they use contextual clues to help in this process. In addition, she is interested in how contextual information and auditory information interact, as well as different models and frameworks we have for understanding that interaction between different sources of information, in neural and behavioral data. Phoebe received her bachelor's degree at Yale University where she studied Linguistics. She then completed her PhD in Linguistics at the University of Maryland. In her free time, she enjoys going on walks and doing yoga. Her biggest piece of advice when choosing a PhD program is to find one that has a supportive environment with supportive people.

1st Year Graduate Student - Psychology - Language and Cognition

**ANNE MARIE
CRINNION**

Anne Marie is interested in how people make use of different types of information to figure out what they are hearing, along with individual differences among regarding the strategies they use to resolve ambiguities in the speech signal. She is also interested in working on computation models of speech perception and spoken word recognition. Anne Marie received her bachelor's degree at Harvard University, where she studied Psychology on a Cognitive Science track, with a secondary in Language & Linguistic Theory. In her free time, she enjoys doing and making crossword puzzles, as well as exercising. Her biggest piece of advice for students is to always ask a lot of questions and follow your passions.



**HANNAH
MECHTENBERG**

1st Year Graduate Student - Psychology - Language and Cognition



Hannah is interested in how reward factors into speech perception at both the behavioral and neural level, as well as the role of language processing in analogical reasoning. Before coming to UConn, Hannah studied at Colorado State University, where she majored in Neuroscience. During her time at CSU, she worked in a neuroimaging lab under the direction of Dr. Carol Seger which sparked her interest in pursuing a PhD. In her free time, Hannah enjoys baking, gardening, and spending time outside. She advises students to ask as many questions as possible, and to reach out for help as often as you need it.

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